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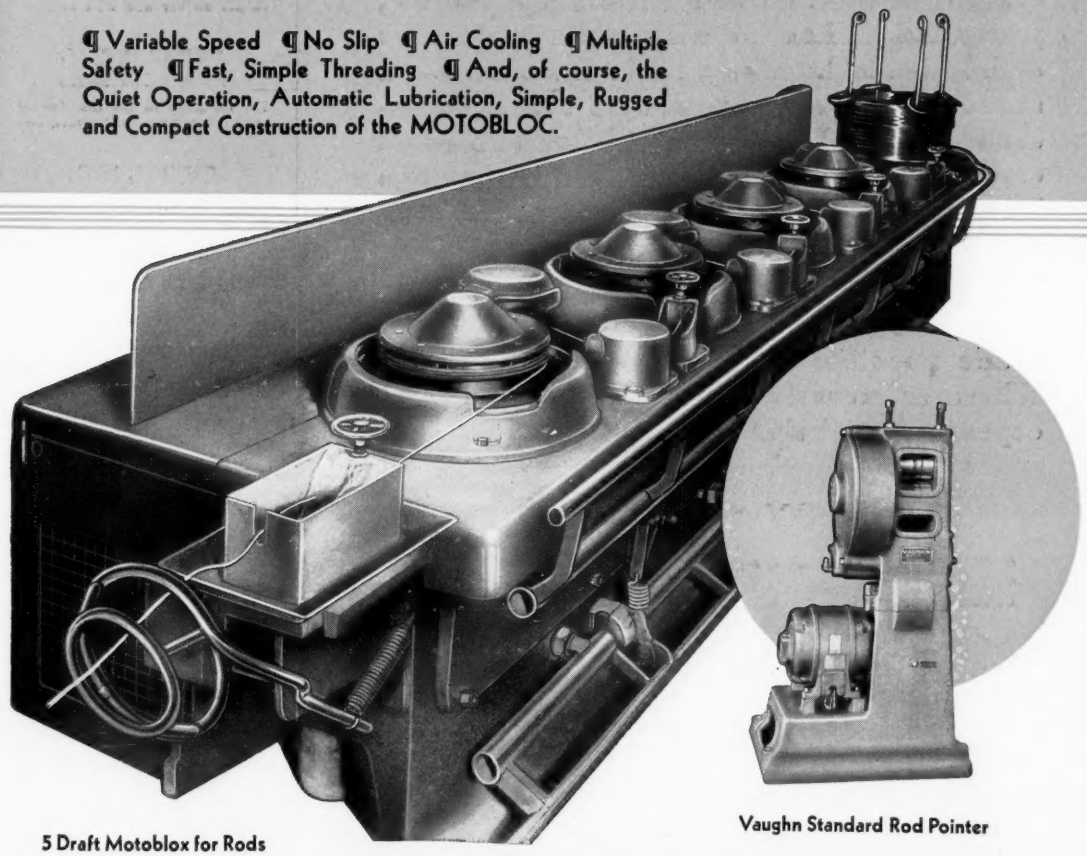

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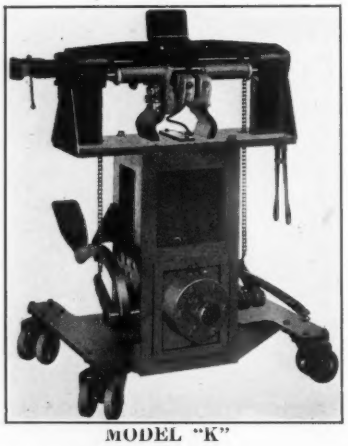

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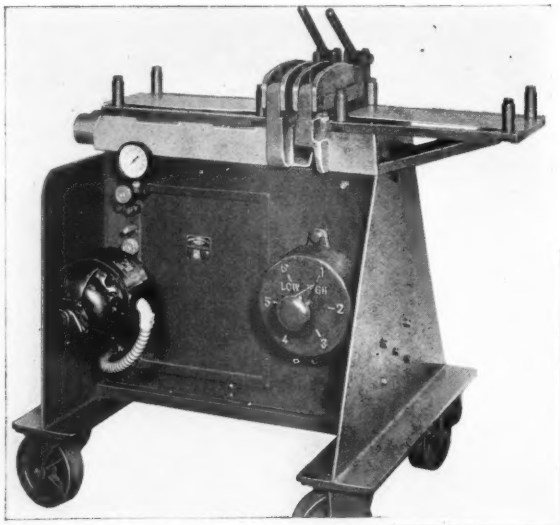

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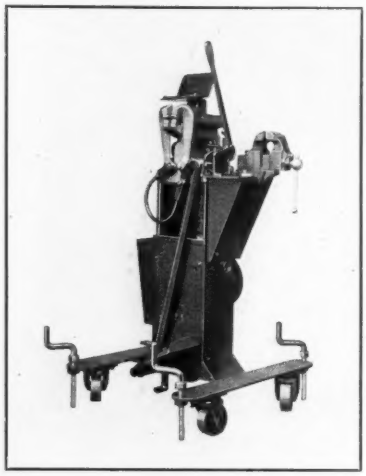

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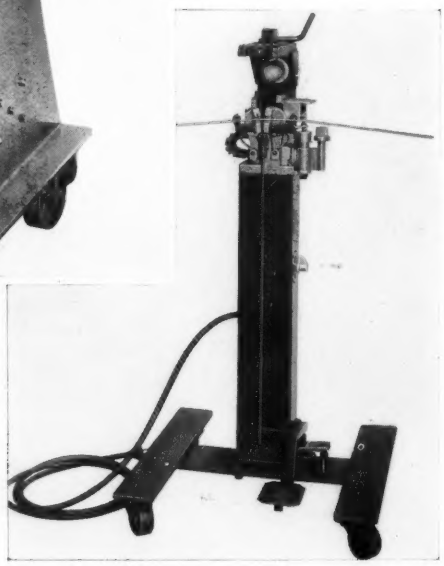

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WIRE & WIRE PRODUCTS

A monthly publication devoted to the production of Wire, Rod and Strip. Wire Products and Insulated Wire and Cable.

DRAWING — ROLLING — EXTRUDING — FORMING — FABRICATING.

Vol. 8 September 1933 No. 9

Designated as

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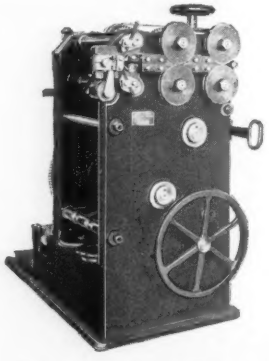

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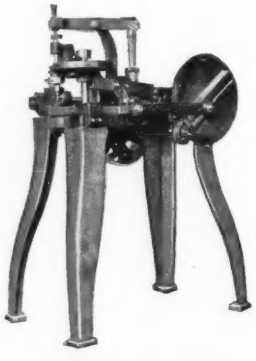

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Wire Products and Insulated Wire and Cable.
DRAWING — ROLLING — EXTRUDING — FORMING — FABRICATING

Vol. 8 | September 1933 | No. 9

Accident Prevention In The Wire Industry

By Milton Meek

An Outline, from the Operator's Viewpoint, of Practices in Wire Mills for the Prevention of Accidents

The indirect costs of accidents, usually absorbed in overhead, represent a considerable charge on the wire industry. Prevention ideas outlined here serve to reduce such costs materially.

ACCIDENT prevention work in the wire industry has, in recent years made considerable progress. As a result, there is in most plants a program designed to avoid those injuries to life and limb which are not only a high charge on production but are a menace to the well-being of all operatives. Despite these precautions, however, the accident rate in wire mills remains high, and all practical methods of increasing the effectiveness of prevention work deserves careful consideration. It is the object of this article, therefore, to consider some practical precautions which are calculated to prevent those accidents which tarnish the character and the reputation of the wire plant establishments in which they occur.

✦ ✦ ✦

Mechanical Safeguarding

ONE of the first steps in developing a program for the prevention of accidents is the safeguarding of mechanical equipment. It is true that safety equipment, repairs and replacements cost money, and in this present period of low profits, many companies have tried to economise in this direction, consequently there has been more than the usual deterioration of materials. It is false economy to defer replacements. The longer they are delayed, the worse the conditions become; every day increases the hazard and every cheap makeshift adds to the final cost. In life, in property, and in money, standard materials and prompt action are the cheapest in the end.

✦ ✦ ✦

ALTHOUGH wide passages between machines are essential for safe working in all departments, it has to be admitted that this lay-out is not always given proper consideration. Machines are so crowded together and the exposed moving parts so numerous that any visitor would stand in awe of seeing a man pass between the machines. Yet workers do this repeatedly, often with disastrous results. Additional precautions in mechanical safeguarding where machines are crowded is of vital necessity. Mechanical guards should be provided to prevent workers or a passer-by from coming in contact with revolving gears, shafts or other moving parts.

✦ ✦ ✦

PROPER care on the part of machinists in any department cannot be too strongly emphasised. In cases where guards have to be removed for the purpose of fixing a machine, the machinist should be instructed to replace them before the machine is started again. Operatives often take advantage where the machine is properly safeguarded and the temporary removal of guards while the machine is in motion becomes a very serious hazard.

✦ ✦ ✦

WHEN making repairs in the mill the millwright should protect the workers by locking all switches or valves controlling machinery, and he must be sure that the work is completed and that all men and tools are clear before the

locks are removed. If it can be said that there is any benefit to be derived from an accident it is the lesson of prevention and the warning against repetition.

✦ ✦ ✦

Inefficient Housekeeping

THE old proverb tells us "that accidents will happen". In the light of modern knowledge we are able to say that accidents need not happen. What exactly is an accident? In the proper answer to this seemingly simple question lies the true secret of success in accident prevention. It is not mere theory, but practical and fundamental principles upon which all safety work must be based.

✦ ✦ ✦

A SIMPLE illustration brings out the principle of accident prevention. A pool of grease lies on the floor of the plant. It may be there until it is cleaned up without anyone so much as stepping in it, or else someone may step in it without being hurt. As a third possibility, an employee may slip and injure himself slightly or seriously. To many people the accident occurs when the man is hurt, but it occurred when the grease collected on the floor in the first place.

✦ ✦ ✦

THE importance of grease on the floor as being a serious hazard is very often overlooked. To step on this slippery surface and fall to the floor close to machinery in motion may result in very serious injuries. Every person, no matter what their job is, should be instructed to keep the floor as clean as possible. Safeguarding habits are contagious; setting the example is the secret of plant discipline. True accident prevention is the recognition and prompt removal of hazards before someone is hurt.

✦ ✦ ✦

REGARDLESS of how well machines are safeguarded, should the housekeeping be inefficient, accidents are liable to happen. Aisles and passageways should be kept free from obstacles over which men may stumble and fall; proper and adequate lighting is very important in preventing accidents, and careful supervision is required at all times to ensure safe piling of materials.

✦ ✦ ✦

ONE of the most important phases of accident prevention is obtaining and holding co-operation of all employees. It is imperative in certain cases that suitable clothing should be worn to minimise the danger of accidents occurring. No matter whether uniforms are provided by the firm or not, the workers will generally respond to the logical appeal for precautionary measures to be taken when operations with unsuitable clothing are hazardous. The fault lies in the supervision which neglects to point out the dangers.

✦ ✦ ✦

Human Failures

SOMETHING has been said about minimizing the danger of hazardous equipment and proper housekeeping, but the need for eliminating human weaknesses which make employes prone to accidents has not received the attention which it deserves. Accidents due to mechanical defects will be reduced by competent plant maintenance as mechanical efficiency in this direction is obtained, while human failures can be reduced by educating the employees to such a point that foolhardiness and carelessness are eliminated or greatly reduced.

✦ ✦ ✦

HERE is a case in point. A man was drilling a hole in the floor of the acid-dipping department. The head of the chisel was badly burred over and the chance of a piece flying off and causing eye injury was apparent. It was suggested that he should have the head of the chisel trimmed as the use of it in such a condition might cause him to lose an eye. It was found that the man had only one eye and on being questioned, he revealed the fact that some years before a piece had broken off the head of a chisel and injured the eye so badly that it had to be removed. It seems incredible that a man who has lost one eye from a similar defect should so thoughtlessly risk total blindness by exposing the other eye to a similar fate. Defective tools should be reported to the foreman and removed immediately, and a "Bad Order" tag attached, until the necessary repairs are completed.

✦ ✦ ✦

SAFE workmanship becomes habitual through repetition of safe practices. To encourage repetition requires educational effort to keep the importance of safety uppermost in the mind of the employees. They should be told what they should do, not what they should not do. Positive suggestions are the sound basis of appeal to employees as having a psychological but beneficial effect. Employees upon being engaged are more susceptible to direction and leadership than at any other time. It is therefore highly desirable at this time to train such a person in safe practices and the safe methods of performing the work undertaken.

✦ ✦ ✦

First Aid Instruction

IT is a good policy for the management of a mill to arrange the formation of group studies in first aid work. Qualified medical men, will in most cases, be willing to address gatherings of workers anxious to acquire information, so that when accidents do occur they can be at once treated and in many instances, serious consequences prevented. Likewise each department in the mill should carry a first-aid box containing the necessary dressings and accessories.

✦ ✦ ✦

BUT first-aid work is to minimise the effects of accidents. The most constructive work is that aimed at prevention—getting at the root of the matter. The management can, first of all, make sure that the mill is in good condition, after which it remains to educate the employees so that they will realize the necessity for doing all they can to safeguard themselves.

✦ ✦ ✦

ACCIDENTS in the wire mill interfere with the work of others, require the training of less competent men to perform the work of the injured employees and, in general, disrupt the organization. The indirect costs of accidents, usually absorbed in overhead expenses, represent a considerable charge on industry.

Early Developments of the Rolling Mill

A Short History of Rolling Mill Developments as compiled by the Research Department of the United Engineering & Foundry Co.

It is thought that the rolling mill may be a development of the early wire drawing bench of the 14th century because of the advantages presented by the grooved rolls over dies.

TO trace the development of the Rolling Mill, one must go back through the ages to that period when man first worked and fashioned metals with a hand hammer, the progenitor of the machine. As he sought to reduce his physical labors by mechanical means, the hand hammer of primitive man gave place to simple mechanisms operated by animal or water power, generally of the "tilt" type.

✦ ✦ ✦

POWER hammers were developed some time before the sixteenth century, but their use for making thin bars or sheets was early seen to be limited to an extent that hand hammer was not. With the tilt hammer, lack of means of controlling the force of impact or the length and position of the stroke, prevented its use for bars less than ¾" square on account of the too ductile condition of the metal when hot, and the too rapid rate of cooling. In order, therefore, to advance the process of mechanical production of metals in bars, shapes and sheets, some other means had to be found.

✦ ✦ ✦

THE first advance was the development of the slitting mill, first used in England by railmakers in 1590, close upon the introduction of the tilt hammer for making sheets. The slitting mill, with the exception of the power hammer is probably the oldest surviving machine existing today in the metal industry. It finds its modern counterpart in the gang slitter, which is used for cutting wide strip into a number of narrower strips. The slitting mill in its essential details consists of a number of hardened steel discs mounted on two spindles placed parallel, one above the other. The discs are so spaced that the discs on one spindle would just enter the spaces between those of the other, so that a flat bar passing between the revolving discs would be sheared into a number of strips, the width of the strips being determined by the thickness of the discs. The first operators of this machine claimed to have reduced the cost of production 25% over previous methods Bars for the slitting mill were hammered down by the tilt hammer or by hand.

Fig. 1. Branca's Metal-Rolling Machine, 1629 ✦ ✦

✦ ✦ ✦

SOME time before the practice of slitting was adopted, the method of rolling which was later to displace the tilt hammer and slitting mill had already been conceived. Exactly who first invented the rolling mill is a debatable question. One of the earliest records of a design for a rolling mill was found in a sketch book, dated 1486, belonging to Leonardo da Vinci, better known for his paintings, who intended it for lead sheets. Records are lacking to indicate whether this mill was ever built in da Vinci's time. Some authorities concede that the rolling mill may have been conceived even earlier than the date of da Vinci, as a development of the draw-bench. Wire drawing was practiced before the fourteenth century and it is possible early operators were aware of the advantages of grooved rolls as a substitute for dies in order to reduce friction and wear.

✦ ✦ ✦

FIG. 1 shows a sketch of an early rolling mill that is indeed an antique. Its invention is credited to an Italian, Signor Branca, in the year 1629, for rolling "masses of gold, silver or other metals." According to the words of its inventor: "A furnace blown by bellows is placed under a chimney. When the furnace is put in operation the air in the chimney is highly heated, and together with the smoke that it produced, causes the flywheel to turn round." The top roll

of the mill is driven through a triple reduction of gearing. An interesting feature of this mill is the lower roll drive, marked "D" in the illustration. This practice was used on "puddle" rolls as late as 1870.

✦ ✦ ✦

IN Fig. 2 is illustrated a mill built more than a hundred years later than Signor Branca's, which indicates a considerable advance in the process. Here we see hand forged bars being rolled into sheets and cut into bars on a slitter. The separate water wheel driven lineshaft drive for top and bottom rolls is of interest. This mill was in operation in 1734, but there are records of rolls being used in conjunction with the slitting mill at least half a century before.

✦ ✦ ✦

THE use of rolls for finishing to accurate size or shape was delayed for want of a roll of necessary surface hardness for that purpose In 1697, John Hanbury, father of the sheet mill, rolled sheets from bars 4 inches wide and 4 feet long Following the invention of the chilled roll by Church in 1725, Hanbury produced tin plates of a superior quality to anything that could be produced under the hammer, and established the rolling mill as a unit of prime importance in the manufacture of metal.

✦ ✦ ✦

IT is interesting to compare the construction of the first mills with the modern units with which we are familiar. Early sheet mills had rolls not over 15 inches diameter and rolled only narrow widths. The housings were constructed of two forged square bars, held upright in timber blocks. The caps were secured by stone or cast iron cotters. The roll chucks were made of timber. Whether our predecessors recognized the bearing qualities of such timbers as lignum-vitae is a matter for conjecture. The roll stand, if we may call it such, was secured to an oak frame, because it was considered dangerous to secure it rigidly to a foundation.

✦ ✦ ✦

IN 1728 we have record of what was then a remarkable mill for rolling lead products. It had a set of plain rolls 12 inches diameter by 5 feet long for sheets, interchangeable with grooved rolls for rolling pipes on mandrils. This was a reversing mill with balanced top roll. Reversals were obtained by gearing and jaw clutches. The mill was furnished with roller tables on each side. These were idle rollers 4 inches diameter by 24 inches long spaced at 12 inches.

✦ ✦ ✦

OUR most modern mill, the 4-High stand, is said to have originally been invented in 1746 by a Swedish engineer, Christopher Pohhem, who recognized the advantages of the small diameter rolls necessarily backed-up by rolls of larger diameter, as a means whereby the power to roll the material could be reduced.

✦ ✦ ✦

THE art of rolling sections with grooved rolls of gradually decreasing section was probably first developed by Cort around 1783, in conjunction with his patented puddling process. Rolling speeds were low. Guides and strippers not being in use, it was necessary for the "catcher" to seize the bar with his tongs as soon as it appeared between the rolls in order to prevent it sticking in the grooves and being wound round the roll.

✦ ✦ ✦

WITH the first bar mills, when rolling rounds, it was necessary to put the bar two or three times through the last pass to obtain a true round free of fins. In such a case the cooling was so fast it was difficult to produce rounds much under ⅝ inch diameter or in more than 12 feet lengths. In 1825 the more modern method of rolling rounds by reducing the bar to an oval section of the same area as the last pass was introduced together with the necessary guides.

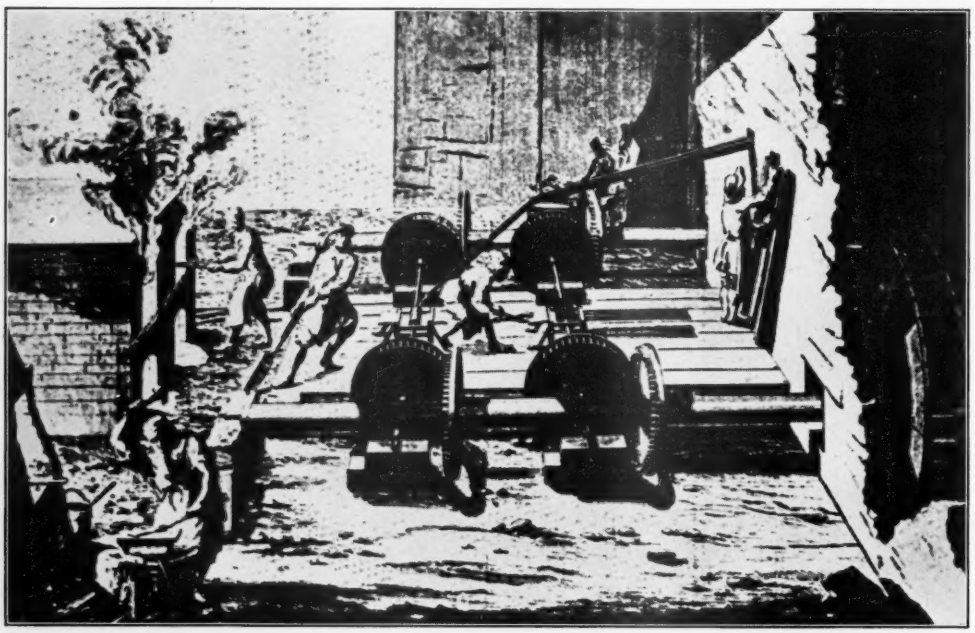

Fig. 2. Ansicht Eines Eisenwalz—Und Schneidwerks. (Nach Swedenborg: De Ferro 1734.)

✦ ✦ ✦

JOHN Fritz of the old Cambria Works, Pittsburgh, is accredited with the introduction of the 3-High bar mill, which doubled the output of the mill and enabled sizes to be rolled down to ¼ inch diameter.

(*Turn to page 282*)

Acid Dipping

By Milton Meek

A compilation of the results obtained from the use of different acids in connection with the production of wire.

THE acids commonly used in wire manufacture are hydrochloric (muriatic), sulphuric and nitric. Hydrofluoric acid is used only in extreme cases, such as exist when the silicia in the furnace tubes has attached itself to the wire. Easily 90 per cent of the wire manufacturers in this country use sulphuric acid, as the principal cleaning medium. It has proved to be cheaper and quicker than muriatic acid, and can be used for all qualities of wire. A further advantage is that there is little risk of acid rust, which is a big drawback in muriatic acid cleaning, and an evil which never fails to make itself apparent if washing has been insufficient, or drying-off too prolonged.

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The Use of Muriatic Acid

THE present practice of immersing the material in the acid, and allowing the latter to remain at the same temperature as the surrounding atmosphere, is one which can be improved. The higher the temperature, the quicker the action, and if the use of steam to heat and agitate the liquor is impracticable, it can be agitated economically by compressed air, while the air ready heated, can be drawn from the drying ovens. Much cleaning liquor is run to waste in this cold working process while it has still strength to perform good service if heated, and in order to gain the fullest value, no liquor should be run to waste if it contains more than one per cent of acid. The best muriatic acid mixture for cleaning wire and wire rods is one part of acid at 28/32° Tw. to two of water. Some manufacturers claim that to use this bath until exhausted, without the addition of further acid, is the most economical, but careful tests prove otherwise, for its scale is removed at fairly short periods, a bath freshened up with new acid not only gives better results, but a grater percentage of material cleaned. The material cleaned in a bath of this description will also draw much better than that which has been cleaned in one in which the acid has not been revived. Some users contend that the scale lying at the bottom of the tank is a deterrent to adding new acid, and it has a tendency to lower the strength, but this opinion is untenable, as the scale is practically insoluble in this acid mixture.

✦ ✦ ✦

THE action of the acid upon the material is rather interesting. The scale, being porous, allows the liquor to percolate through to the metal, with which it evolves hydrogen. This gas, as it expands, actually loosens and forces away the scale. After the material has been allowed sufficient time to clean, it is washed to remove loose scale, and then dipped into a bath of milk of lime to neutralize any acid which remains. From here it is taken to the drying ovens. The heat applied in the drying ovens also serves the purpose of driving off further acid which the milk of lime has failed to remove, in cases where acid has penetrated into the pores of the metal

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The Use of Sulphuric Acid

THE process of cleaning with sulphuric acid is similar to that of using muriatic acid, with the exception that it is essential that the liquor be heated before efficient action can take place. A bath made up of 5 per cent, sulphuric acid, and working at a temperature of between 70° and 90° C., is the best mixture for wire cleaning. It is necessary to keep the temperature of this solution as nearly constant as is possible. If the dipping department is well able to cope with the demands of the drawing mill and time can be spared for longer immersions, a 2 per cent acid solution, with increased temperature, will produce material that will draw much easier. The action of the sulphuric acid bath is somewhat similar to that of the muriatic acid bath, but the scale is converted into ferrous sulphate. Unlike muriatic, there is therefore a point where the addition of further acid is merely waste, due to the accumulation of ferrous sulphate, and at this point the liquor should be run off and the tank cleaned out. Where wet drawing is part of the manufacturing process it is usual to recover this ferrous sulphate. For this purpose the spent liquor should be run off into a spare tank and concentrated by steam heat until it reaches a specific gravity of 75° Tw. In the cooling process the ferrous sulphate will crystallise out, and the remaining liquor can be used in making-up a fresh bath.

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Nitric Acid

NITRIC acid is rarely used in the cleaning of common steel wire, the high cost as compared with that of muriatic and sulphuric acids being the deterring factor. It has, however,, come much to the front as a cleaning medium for stainless steels, especially in conjunction with sulphuric acid. Many experiments have been conducted

(*Please turn to page 282*)

The Wire Drawing Die

By Kenneth B. Lewis
Consulting Wire Mill Engineer, Worcester, Mass.

PART III

A study of die stresses and strains during the drawing operation. Many of the ideas presented here are new and it is quite probable that some of the theories outlined will cause considerable discussion in the industry. The author invites such discussion in an effort to clarify the available data relating to die stresses.--The Editor

NEEDLESS to say, lubrication is of prime importance in the die, although the word itself is somewhat confusing in this connection. It carries with it a suggestion of an oily fluid bathing the surfaces in contact, sticking to them both, and splitting as the surfaces move on each other, so that a film of lubricant clings to each surface, the friction being really between these two films. This is the condition in the usual shaft bearing, and in wire drawing we have a situation which bears a superficial resemblance to it. Our die is a bearing, our wire is a shaft moving in it and giving rise to friction. Here the resemblance stops. The wire drawing die does a job of deforming at the same time it is creating friction. It is the only bearing in which two coacting units of surface meet for an instant and then never meet again. And the strangest thing about it is that the pressures are enormously greater than are encountered in any other job. Bearing experts deal customarily with pressures of a few hundred pounds per square inch. If the pressure rises to 5000 lbs. they consider it a miracle of skill to be able to maintain a lubricating film. We wire drawers are working our bearings at unit pressures ranging from 50,000 to 350,000 lbs. per square inch. Our lubricating problems are unique. No engineering handbooks carry any information of the sort we need.

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GENERAL laws have been developed during the past hundred years, dealing with lubrication, and friction. Two types of friction are recognized, the lubricated and the un-lubricated. Between them lies a zone of scanty lubrication, in which the laws vary as the conditions vary. One would naturally assume that since we are scrupulously careful to "lubricate" our wire in the die, the laws of lubricated friction would apply, and I wasted many weeks trying to make them fit the known facts. Finally I resorted to the sound scheme of writing down on paper everything I knew or suspected about the frictional relations between the die and the wire. Then I drew up in parallel columns the various laws of dry and lubricated friction and checked them. Wire drawing belonged very clearly in the column of dry friction. I applied its laws to the problem and the formulas which had been eluding me fell into line at once.

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HERE are the opposing laws. I quote them from Goodman's "Mechanics applied to Engineering".

	Dry Surfaces	Lubricated Surfaces
1	Frictional resistance is nearly proportional to pressure.	Frictional resistance is nearly independent of pressure when lubrication is ample, but depends directly on area.
2	Friction is nearly independent of speed at low pressures.	Friction varies directly with speed at low pressures. At high pressures friction is very great at low speed, reaches a minimum at 100 f.p.m., then increases as the square root of the speed.
3	Friction is not greatly affected by temperature.	Friction depends very much on temperature.
4	Friction depends on the nature of the surfaces.	Friction depends only slightly on the nature of the surfaces.
5	Friction of rest is slightly greater than friction of motion.	Friction of rest is enormously greater than friction of motion.

LOOKING over these items one by one we note first that dry friction is nearly proportional to pressure. We have certainly found it so. Right at this point there is something to be cleared up. We have found friction varying directly with the **area** of the surfaces in contact. This is consistent with the laws of lubricated rather than of dry friction, but here we must remember the peculiarities of wire drawing. We have to bring the wire up to the unit stress that is its yield point in compression, using the bearing for this purpose, and so it happens that our friction varies not only with the total pressure but with the total area as well, since in this unique case the total pressure depends on the total area.

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ITEM 2 is perfectly clear. It has been proved over and over that die pull is practically independent of drawing speed. If die friction was "very great at low velocities" as in lubricated friction, we would never be able to pull out a point. Item 3 is not quite such a clear cut case but the dry column looks better. We draw wire between 70° and 350° Fahrenheit with no noticeable difference in die pull.

Item 4 puts us squarely in the dry column. Everybody knows how important a smooth die is. Item 5 puts us very definitely among the dries. It takes just a little more pull to start the draft than to keep it moving. On the other hand it is well known that a machine with many lubricated bearings, or say a shop full of line shafts, needs a tremendous application of force to start it from rest, sometimes 25 or 30 times its normal running load.

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BY this checking up of laws, and by the fact that we have developed what looks very much like a reliable theory and formula based on the laws of dry friction, we are forced to the conclusion that there is no lubrication in wire drawing. This is hard to grasp. According to the best authorities the coefficient of friction of ferrous metals on each other with no lubrication or with very scant lubrication ranges from .20 to .25. We believe we have a figure of .07 to .10 for dry drawing. The answer is that in dry drawing we are not measuring the friction of metal on metal, but of soap film on metal. The wire never touches the die. What we do in the cleaning house, baker, and die box, is to build up on the rod a tightly adhering stiff envelope made of sull coat, lime, and soap. This material rubs on our die, and the figure we get for cf. is a measure of the friction between this film and the die. The steel wire is nothing but a re-inforcement to keep this film rigid. Soap or grease alone gives wire no help. Bare wire will run through it and scratch at once. The lime coat, however, is of a loose porous structure, full of little pockets into which the soap or grease beds down so that the terrific pressure in the cone can't shove it back. How is the lime coat anchored? It is entangled with the rough porous sull coat. The sull coat is rust. It is bonded tight to the steel because it is in process of formation out of the steel. Wet steel rusts so quickly that you can't get it from the water to the lime quick enough to avoid a little sull. Even bright wire is slightly sulled.

SO we have a soap coat which can't be pushed back out of the cone because it is tangled and bedded in the lime, which can't be pushed off because it is entangled with the sull, which can't be pushed off because its roots grow right out of the steel base. We are drawing a film of soap-lime-sull, and the steel wire is reduced because it happens to be inside the film.

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LET us take another look at our basic formula, D.P.=M.Y.P. (A—a) (1+cot cf.). Which of these factors can be most easily influenced to our advantage? Yield point seems to be a fixed property of the metal. We lower it all we can by annealing, and then it seems we have done all we can do. A—a is of course the measure of our draft. If we reduce it we save die pull but our saving is quickly eaten up by extra drafts. We can presumably affect cf. by keeping a sharp eye on our coating practise and using well polished dies. That leaves us the cotangent. The die angle is to some extent under our control. If it is too small our friction rises and the wire breaks. If it is too large the die wears faster, and there is constant danger of cuppy wire. There is for each reduction a range of angles in which work can be done. The die reamer knows this range from experience, and he puts us into it. If the job is one he has had before, his memory supplies the right answer; if it is an entirely new set of conditions he reasons from what his experience has been on jobs which seem to be similar. In other words, in this matter of the die angle, perhaps the most important thing in wire manufacture, we are entirely at the mercy of the die maker's experience and memory. We can check his results, but we can't follow his reasoning. With all due respect to the die makers, this is an intolerable situation. We have a formula that tells what results from the use of a certain die angle. It seems as though we ought to be able to turn it around and learn what angle to use to get certain results.

A sound way to start after some unknown principle is to write down all that is known about the matter and shuffle these facts around until they take some sort of pattern. I have for years been collecting such opinions on die shapes as I found generally accepted among first class die men. Die makers are in general agreement on familiar jobs, and on unusual problems their solutions, while varying in detail, seem to bear some sort of resemblance to each other. After a long struggle with the data I found one constant relation between the die shape and the job. When the best conditions are found for a given job there appears to be a fixed relation between the total contact area between die and wire, and the area of the entering section. In dry drawing this ratio is four to one. In wet drawing the ratio is considerably less, about two and three quarters to one, so far as my data goes, though I have not enough reliable data on wet work to check this figure properly. Contact area means of course area of cylindrical bearing as well as cone, and it seems to make no difference, within the limits of normal practise, how the area is divided between cone and cylinder, provided of course that the wire is really in contact with the cylinder, and not sucking down at the mouth of the cone. The rule appears to hold for high or low carbon alike, and for the non-ferrous metals. To put this into a general statement, die angle depends on the reduction, and not on the material.

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AS I said before, it is a tedious job to calculate cone and cylinder areas. I spoke of the use of a special slide rule for the purpose. Since bearing length is expressed in percentage of finished diameter, and contact area depends on starting diameter as well, such a rule can be devised only for a constant contact ratio. Assuming such a ratio, the diameters can be set over one another on the lower scales and a set of 5 or 6 scales on the upper edge of the slide can be so marked off as to indicate directly the percentage reduction, the total

die angle required to give the chosen contact ratio in a simple cone, and the angles which will give this ratio when associated with cylindrical bearings of say 10, 25, 50 and 75% length. The reverse side of the slide can be used for wet drawing, with scales based on a suitable contact ratio for wet work. If the "contact ratio" theory is sound, such a slide rule is really a card-index of the combined experience of all die makers.

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LET us return now to the basic formula and consider the chances of checking one of our two unknown factors. Professors Thompson and Francis of Victoria University, Manchester England, have done much careful work on the flow of metals in dies. Among other things they investigated the effect of die angle on die pull. Fig. 9 is a chart of several non-ferrous metals showing how the die angle affects the pull. Starting at the upper left hand end of each curve it is seen that as the angle becomes larger and the die pull drops. This is of course because the contact area, and therefore the total pressure, is dropping. We assume that the force required to deform is constant, and friction is decreasing. But when the half-angle has reached about 6° something happens—the curve turns up again, and die pull begins to increase. Why is this? The factor A—a is the same, the cotangent is under strict control, so it is clear that either m.y.p. or cf. is changing with the angle. It is awkward to have to admit that the theories and formulas developed up to this point have some flaw or variable, but the fact cannot be ignored, especially as unpublished curves for steel show the same general shape. Since the crystals of which metal is made up lie entirely at random it is hard to understand why a difference in the angle at which pressure is applied should affect the stress required to deform the mass. On the other hand coefficient of friction is generally a very stable property of metals, changing only when very great changes in pressure or temperature cause radical changes in surface conditions. Let us see what can be got out of Prof. Thompson's chart. Though we may still have to make some assumptions, perhaps we can narrow them down.

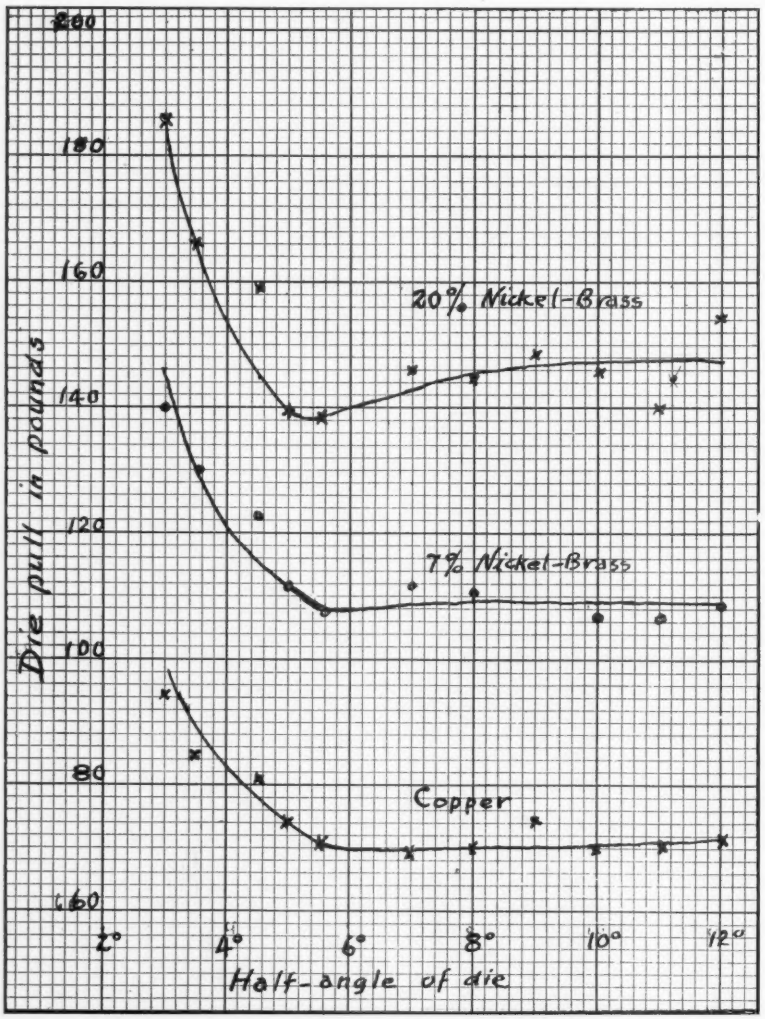

Figure 9.

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FROM the general shape of these curves we assume that in the upper part, before the 6° break comes, the yield point and coefficient are relatively constant and the only thing that is affecting die pull is the increased friction due to area. Let us go back to the formula.

D.P.=m.y.p. (A—a) (1+ cot cf.). The rules of mathematics permit us to write this $\frac{\text{D.P.}}{1+\cot \text{cf.}}$ =m.y.p. (A—a).

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WE know the m.y.p (A—a) is the horizontal component of the deforming force, and we believe that this component is always the same. Then for any two points on the curve,

above 6°, $\frac{\text{D.P.}}{1+\cot \text{cf.}} = \frac{\text{D.P.}}{1+\cot \text{cf.}}$

Try this equation for the 3° and 5° points on the 20% nickel brass. It runs like this,—using X for the coefficient of friction.

$$\frac{186}{1+19.08X} = \frac{141}{1+11.43X}$$

We simplify this by multiplying each numerator by the denominator of the other term and it becomes 186+2120X=141+2690X, or, bringing similar terms together, 186—141=2690X—2120X, or

45=570X, or X=.079. This .079 is the value of cf. which will satisfy the two points chosen. Take two intermediate points on the curve, 3½ and 4½ degrees.

$$\frac{166}{1-16.35X} = \frac{145}{1-12.71X}$$

This solves out to X=.081, which is close enough for a check. Now we can spot the m.y.p. for all these jobs between 3 and 5 degrees. We have Prof. Thompson's word that all drafts were from .080 to .064, so the A—a is .00181. We will fill in the formula all but m.y.p. and get that by calculation. m.y.p. X .00181 (1+19.08X079) = 186. Working this out we get 41,000 lbs. per square inch for m.y.p.

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OF course we will get the same figure all the way down to 5 degrees where the curve begins to break. If we follow along the other branch of the curve, assuming cf. to remain constant and calculating a mean yield point for each angle we get the following: at 6°=45,000, at 8°=51,500, at 10°=56,000, at 12°=59,000. For the second curve, which is 7% Nickel brass, I make the coefficient .07, the m.y.p 33,500, and the maximum m.y.p. at 12°=46,000. The third curve is copper, cf.= .082, m.y.p. 21,000, maximum m.y.p. 28,000. All these specimens were drawn in soap and the results seem to support our belief that cf. for soap coating lies between .075 and .10. One thing to be noted is that the curve is steady down to the point where the ratio of contact area to entering area is 4 to 1. This is at 5° half-angle. The curve dips a little lower than this but it is getting pretty unsteady. On the whole the die makers showed good judgement in making that ratio 4 to 1. It seems probable that at the very bottom of the curve we are near the point where cuppy wire threatens.

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WE have assumed coefficient to be constant, and m.y.p. to vary with the angle beyond the break of the curve. We must keep in mind that we have not yet proven which is the varying factor. If m.y.p. is constant, cf. will vary, along the flat part of the curve, from about .07/.08 to a value of about .16 at a half-angle of 9°, and as high as .25 at 12°. Which of these factors is actually the variable is a point that will be brought out later.

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I must now confess that I have not reproduced exactly the curves traced by Prof. Thompson. I have shown his fixed points, but as he admits that there is plenty of ground for differences of opinion in tracing the curves I have taken the liberty of shaping them to support the theory which I hoped to strengthen, and believe that shape is as logical as any other. The difficulties are serious, not only of tracing curves from such data, but of securing reliable data. Die pull fluctuates considerably without apparent reason, especially in first drafts after annealing, and especially in wide angles and low contact ratios. In the latter case the vibrations are perhaps linked in cause to that "whipping" of an insufficiently supported wire which is thought to lead to development of a cuppy structure. Hard wire is apt to give a rapidly fluctuating die pull, especially if the lead between die and measuring device is too long, the wire leaping through the die in a series of elastic bucks whose mean value is hard to estimate. Such curves as those relating die pull to cone angle ought to be supported by large numbers of determinations.

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WITH regard therefore to the deductions made from these curves we can say only that the deductions are not inconsistent with the data. Such evidence as they give may be accepted as corroborative only, helping to slowly build up a case out of circumstantial details.

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MESSRS Francis and Thompson carried their research into other phases of non-ferrous practise and some of their findings are of interest in this study of ours. They found a difference of 25% in die pull between a brilliantly polished die and one with a less brilliant though adequate finish. This confirms our judgement in placing wire drawing in the non-lubricated class, in which the nature of the surfaces is of great importance. In comparing die-pull with soap and with various wet lubricants, using the same material and the same dies, they found that the best wet lubricants gave die-pulls 80% higher than dry soap. It appears from their data that if the coefficient in dry drawing ranges .07 to .10 the range with soft or wet lubricants is .13 to .19. They remark on the uniformly dull appearance of soap-drawn wires and the high polish of those drawn wet. No better evidence than this well known fact could be desired to support the theory that there is no true lubrication in wire drawing. The polish on wet drawn wire can come only from contact with the polished die, and only through metal-to-metal contact. The dullness of soap drawn wire is sufficient proof that the metal never touched the die. The soap film is highly polished, but through this thin semi-transparent film the dull pickled surface of the metal reflects its unchanged condition. In neither case is there anything resembling our conception of lubrication. It is possible that wet lubricants are entrapped, in extremely minute amounts, in the microscopic pits of the metal surface, and so modify the process as to permit it to be described as "scanty lubrication". The coefficient is, in fact, a bit lower in wet drawing than would be expected. It is extremely probable however that the chief, perhaps the only function of the wet lubricant is to cool the dies and wire, and in the case of continuous drawing to lubricate the rolls.

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MESSRS Francis and Thompson suggest that the drawers of non-ferrous wire might well consider seriously the advantages of dry-drawing. The non-ferrous industry has developed around the use of soft greases and wet lubricants, light drafts, and high polish. There is a sacrifice of power, die life, and probably labor, in return for advantages in uniform drafting practise, speed, and finish. It is a point for their consideration.

New Bend Testing Machine

By A. C. Blackall
London, England

A Description of the New Johnson Bend Testing Machine as Developed by the Sheffield University Research Department, Assisted by the Patented Steel Rope Wire Association.

DURING the past year Sheffield University's research department for the cold-working of steel assisted the Patented Steel Rope Wire Association in its inquiry to decide the best features to be incorporated in any design of bend testing machine submitted. A satisfactory machine was eventually designed by a member of the association's inquiry committee.

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THIS new machine is stated by its designer, Robert Johnson, to be still in tentative form. However, it possesses features which are an improvement on the Tarnogrocki bending machine, which is in common use in the industry. Hitherto, in order to cover the range of wire sizes used in rope making, it has been necessary to employ a battery of four bending machines. Each machine was designed for a small range of sizes only, the dies not being interchangeable.

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IN the Johnson machine provision has been made whereby the dies are easily interchangeable, and one machine can thus be made to cover the whole range of wires. In addition, instead of confining the number of ranges to four, namely, dies of 2.5 mm., 5 mm., 7.5 mm., and 10 mm. radius, two additional ranges have been introduced, one of 3.25 mm., and one of 6.25 mm. The object of this increase is to group the wires in such a way that the number of bends given by the wires in one range shall differ only by at most one or two bends.

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IN bending machines at present on the market the jaws for gripping the wire are rigidly fixed to the bending radii and are so arranged that one jaw is fixed and the other is made to approach it by means of either a screw mechanism or a cam operated motion.

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THIS, while reducing the cost of production of the machine, unfortunately throws the wire test piece out of alignment, except for one particular size of wire, because the bending arm is also of necessity fixed in one position. Although the difference in the result of the test may be negligible, it is a fault which should be absent from a scientifically designed apparatus.

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THE Johnson machine has eradicated this error by sliding the jaws simultaneously towards the center line of the bending arm with a screw motion, which has a right hand thread at one end and a left hand similar thread at the other end. The jaws thus approach one another at a uniform rate and grip any wire, holding it in position at right angles to the center line of the bending arm. Provision has been made for fine adjustment of one jaw to cover slight errors due to either machining or wear in use. The various dies slip easily into position in the jaws and are rigidly held by a locking screw.

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THE bending arm, which is mounted on a double row of ball bearings, has an interchangeable arm which can slide up and down the operating handle. The object of this is to ensure that the arm is located at a position best suited to the size of the wire. The holes are marked according to the gauge of wire and are made two sizes larger than the gauge of wire they hav eto accommodate, so as to allow of the easy removal of a fractured specimen.

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THE machine is claimed to be a distinct improvement on existing devices from the standpoints of ease of manipulation and versatility. It were better if some device for locating the wire in a vertical position could be incorporated into the grips, as this would assist in preventing any tendency to twist during the bending process—a failing very evident in the Tarngrocki apparatus.

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THE second machine is a commercial model which was submitted for test by Bruntons, Ltd., of Musselburgh, Scotland. The Sub-Committee on Bending Machines of the Patented Steel Rope Wire Association favorably received the machine and recommended a test against one of German design. As the Brunton machine was only fitted with 5 mm., radius dies, additional dies were made of 2.5 mm., 7.5 mm., and 10 mm. radius. The tests were satisfactory.

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IN this model the wire is gripped in a vertical position by plates attached to the sides. Both dies move simultaneously towards the center line of bending, and the handle which moves the dies is adjustable so that it does not interfere with the bending arm. The bending arm is of fixed length and is carried in a bearing on each side of the machine, thus bridging the dies.

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A NOVEL feature of the machine is the provision of guides, both on the bending arm and in the gripping device, thus

(*Please turn to page 284*)

N. R. A. Activities Among The Manufacturers

Of interest to all Wire Manufacturers as well as the various producers of wire mill machinery, dies, etc., is the recent organization of three separate associations under the NRA, among the manufacturers who sell wire mills. ▼ ▼ ▼ ▼

National Machinery Builders Association

ON August 10th, a meeting was held at the Hotel Commodore, New York, N. Y., to organize the Wire Machinery Builders' Association. Among those present were:

Philip M. Morgan—Morgan Construction Co.; L. A. Vaughn—Vaughn Machinery Co.; George D. Hartley—Sleeper & Hartley, Inc.; J. A. Kreitler—H. J. Ruesch Machine Co.; Josiah Judd—Thomson-Judd Wire Machinery Co.; A. R. Petterson—Thomson-Judd Machinery Co.; W. D. Pierson—Waterbury Farrel Fdry. & Machine Co.; E. F. Shuster—F. B. Shuster Co.; E. J. Scudder—E. J. Scudder Foundry & Machine Co.

Mr. Philip M. Morgan was appointed Chairman, Mr. George D. Hartley, Secretary pro tem.

After discussion and amendments in various particulars, the Constitution and By-Laws, which had been drawn up at the previous organization meeting, were adopted unanimously upon the motion of Mr. Judd, seconded by Mr. Vaughn.

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NOMINATIONS for officers were then in order and the following officers were nominated and elected:

President: Philip M. Morgan; Vice-Presidents: L. A. Vaughn and Josiah Judd; Sec'y-Treasurer: George D. Hartley; Executive Committee: W. D. Pierson, E. F. Shuster, L. A. Vaughn, E. J. Scudder; Code Committee: J. R. Dorer, A. R. Petterson, W. D. Pierson.

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THE matter of the code was then taken up and discussed at great length and it was formally moved by Mr. G. D. Hartley and seconded by Mr. Vaughn, that this Association ally itself with M. A. P. I. and submit its code through them to the Washington Authorities. This motion was adopted unanimously.

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THE Chairman then read the Basic M. A. P. I. code and which, with certain amendments, alterations and eliminations, became the code as adopted by the members present.

The President was authorized to represent this Association to M. A. P. I.

The association makes an appeal to all builders of special wire working machinery and wire mill equipment to become members of the new association.

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The Braiding And Wire Covering Machinery Association

THIS organization is composed of over 90% of the producers of this type of machinery, with the following officers:

President: H. W. Anderson—Fidelity Machine Co.; Vice-President: N. E. Richard—Textile Machine Wks.; Secretary and Treasurer: C. S. Barningham—New England Butt Co.

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A code has been submitted to Washington which closely parallels the code of the TEXTILE MACHINERY MANUFACTURERS' ASSOCIATION. The first hearing has been held and it is expected that this group will be functioning immediately.

Association of Wire Rod and Tube Die Manufacturers

AS a result of several meetings, the Association of Wire, Rod and Tube Die Manufacturers was organized and incorporated with the following concerns among the initial members:

Atlas Wire Die Co., Balloffet Diamond Die Co., Cochaud Wire Die Corp., Delage Luhrs Co., Driver-Harris Co., Eastern Diamond Die Co., Kelly Wire Die Co., Krause & Co., Newark Wire Die Co., Standard Diamond Tool Corp., Triangle Wire Die Co., Union Wire Die Corp., Vianney Wire Die Corp.

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THE present officers are the following:

Chairman: Leslie C. Jacobson; Vice Chairman: Martin Simon; Advisory Board: F. Durand, V. J. Boulin, W. H. Oraze; Secretary and Treasurer: Lee Heyer White.

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IT is the aim of this Association to stabilize the practice of all manufacturers and importers of dies, and to cooperate in every way possible with the purchasers of dies, and any complaints that they may care to make to the Association regarding any one in the industry, with the idea in view of correcting all the objectionable features that they may hear of.

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WHILE the diamond die people have fairly comprehensive representation it is quite apparent that the principal producers of Tungsten Carbide dies are not fully in accord with the set up of the Association as neither Carboloy Co., Ludlum Steel Co., Ramet Corp. of American, nor Firth Sterling Steel Co., have identified themselves with this group up to this time.

(*Please turn to page 285*)

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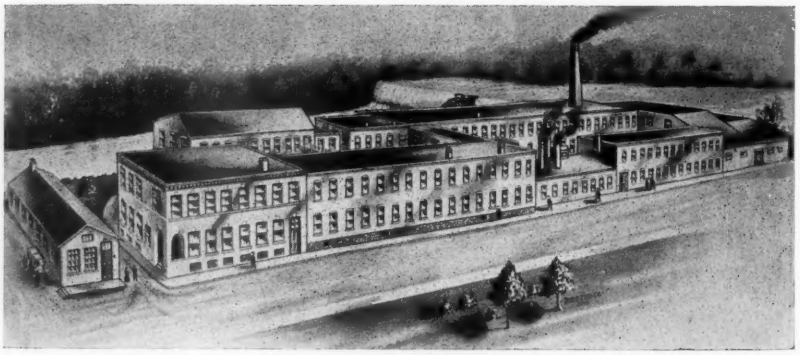

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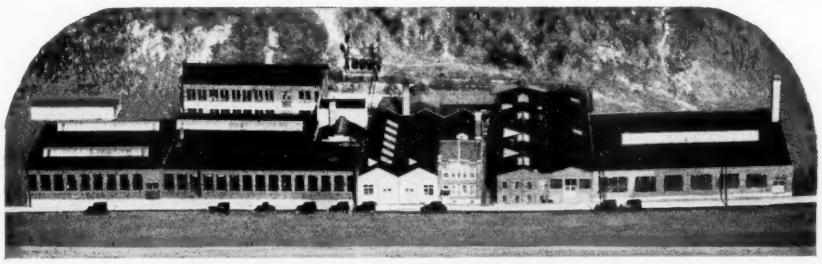
For Enameling Purposes...

▲ ▲ ▲ Electrolytic and Oxygen Free ▲ ▲ ▲



AERIAL VIEW OF PLANT OF HUDSON WIRE CO., OSSINING, N. Y. ▲ ▲ ▲
▼ ▼ ▼ FINE WIRE MANUFACTURERS ▼ ▼ ▼

"HUDCO" High Conductivity Electric Wire

OTHER FINE BARE WIRES

High Brass, Low Brass, Zinc 99.99+ and High Tensile Zinc, Commercial Bronze Phosphor Bronze, Pure Tin, Lead, Antimonial Lead, Cadmium, 10%, 18% and 30% Nickel Silver, Silver Plated Copper, False Gold and Special Brass and Bronze Alloys to Specification.

BRUSH WIRES, CRIMP and STRAIGHT

Brass, Steel, Nickel Silver, Copper and Phosphor Bronze

TINSEL LAHNS

Silver Plated Copper, False Gold and Copper

METALLIC FIBRE FOR PACKING PURPOSES

Copper, Bronze, Zinc, Lead and Aluminum

Wires for Metal Sprays

Zinc, Tin, Lead, Copper, Commercial Bronze, High Brass, Low Brass, Cadmium, 10% Nickel Silver, 18% Nickel Silver, Aluminum, Monel Metal, Phosphor Bronze, Pure Nickel. Other wires to specification.

"Hudco" copper wire is drawn by the Hudson Wire Company of Ossining, N. Y., who have been specialists in the manufacture of fine wires for over thirty years. ▲

The best grade of copper drawing stock is used, insuring the maximum conductivity. ▲ ▲ ▲

A new process of drawing and annealing is used which produces a wire unusually smooth, clean and uniform in color for enameling and other purposes. ▲ ▲ ▲

Painstaking care in the selection and maintenance of dies guarantees a product accurate to gauge and resistance. ▲ ▲ ▲

You can rely on "Hudco" wire always. ▲ ▲ ▲

Expert annealing of the wire prevents unnecessary breakage when winding the wire into coils. ▲ ▲ ▲

If you, too, have a specific problem demanding wire of exact requirements, write to us about it. ▲ ▲ ▲

It costs nothing and involves you in nothing. ▲ ▲ ▲

Better wire at lower cost. ▲ ▲ ▲

We can serve you quickly and economically.
Send in your specifications for a quotation.

"HUDCO" FINE WIRES

HUDSON WIRE COMPANY

Ossining, N. Y.

"HUDCO" FINE WIRES

Estab. 1902 — Successors ROYLE & AKIN — Estab. 1902

A Review of Recent Wire Patents

No. 1,912,442, LOADED CABLE, Patented June 6, 1933, by John J. Gilbert, Douglaston, N. Y., assignor to Bell Telephone Laboratories, Incorporated, New York, N. Y., a Corporation of New York.

An object of the invention is to reduce cross-talk, due to longitudinal magnetic induction in a multi-conductor cable by pairing the conductors so that the longitudinal component of induction of one conductor balances or neutralizes that of the other.

✦ ✦ ✦

No. 1,912,548, SUBMARINE CABLE, Patented June 6, 1933, by Willoughby Statham Smith, Benchams, Newton Poppleford, Henry Joseph Garnett, Solefields, Sevenoaks, and Henry Charles Channon, London, England.

Particularly, the invention relates to the manufacture of material for insulating submarine cables. This material comprises purified gutta percha free from resin and dirt, and the inventor claims has a low leakance of under 2 micro-michromhos per centimetre cube at 1000 cycles and at 75° F.

✦ ✦ ✦

No. 1,912,940, WIRE STRAIGHTENING MACHINE, Patented June 6, 1933, by Henry C. Herr, Buffalo, N. Y., assignor to Herr Manufacturing Company, Incorporated, Buffalo, N. Y., a Corporation of New York.

The wire is fed thru the machine and presented to a high speed straightening roller which keeps the same constantly at a neutral point between bending and non-bending and which touches every point of the wire.

✦ ✦ ✦

No. 1,913,292, BRAIDING MACHINE FOR COVERING WIRES, Patented June 6, 1933, by Hans Schweiter, Horgen near Zurich, Switzerland.

Two cover layers are provided having opposite winding directions and are made to interlace only at two diametrically opposite places.

✦ ✦ ✦

No. 1,913,889, INSULATING ELECTRIC CONDUCTORS, Patented June 13, 1933, by Isidor Kitsee, Philadelphia, Pa., assignor to Mineralite Corporation, Philadelphia, Pa., a Corporation of Pennsylvania.

External layers of tape are wound spirally on the wire cable, the tape being composed of a mixture of mineral wool and synthetic rosin. It is claimed high dielectric and heat resisting properties result.

✦ ✦ ✦

No. 1,914,083, NITRIDED SPRING, Patented June 13, 1933, by George M. Eaton, Ben Avon, Pa.

The inventor provides a nitrided steel spring composed of carbon between 0.15 and 0.35 parts, manganese of between 0.40 and 0.80 parts, aluminum of between 1.00 and 2.50 parts, molybdenum of between 0.40 and 1.00 parts.

✦ ✦ ✦

No. 1,914,097, INSULATED ELECTRICAL CONDUIT, Patented June 13, 1933, by Charles A. Barker, Highland Park, N. J., assignor to E. I. du Pont de Nemours & Company, Wilmington, Del., a Corporation of Delaware.

Complete Descriptions and Drawings of Patents May Be Had for 25 cents. Address, Wire & Wire Products, 17 East 42nd St., New York.

A coating is provided in this patent comprising cellulose acetate, triacetin, magnesium carbonate and rottenstone.

✦ ✦ ✦

No. 1,914,136, WIRE DRAWING APPARATUS, Patented June 13, 1933, by Einer W. Larsen, Chicago, Ill., assignor of Western Electric Company, Incorporated, New York, N. Y., a Corporation of New York.

Varying speed is provided in this construction so slow movement may be imparted to a capstan of a wire drawing machine to facilitate the stringing of the wire thru the dies.

✦ ✦ ✦

No. 1,914,164, STRAND SERVING DEVICE, Patented June 13, 1933, by Richard L. Rice, Fanwood, N. J., assignor to Western Electric Company, Inc., New York, N. Y., a Corporation of New York.

A trunnion and pad assembly is provided and so arranged that the supply of tape may be easily replenished without interferring with the opposite supply pad and the tape being fed thereon.

✦ ✦ ✦

No. 1,914,975, WIRE STRAIGHTENING DEVICE, Patented June 20, 1933, by Michel Nigro, Worcester, Mass., assignor to Sleeper & Hartley, Inc., Worcester, Mass., a Corporation of Massachusetts.

This machine is adapted to operate with wire forming machinery. A single set of rolls are arranged for simultaneous straightening of the wire in more than one plane.

✦ ✦ ✦

No. 1,914,976, MACHINE FOR COILING HELICAL FORMS, Patented June 20, 1933, by Michel Nigro and Percival S. Thomas, Worcester, Mass., assignors to Sleeper & Hartley, Inc., Worcester, Mass., a Corporation of Massachusetts.

This patent covers a machine for coiling rectangular stock flatwise into helical form for roller bearings. All of the coiling tools are mounted on a head which is in turn mounted on a pivotal axis passing thru one of the tools substantially at the point of coiling or stock deflection, by this tool.

✦ ✦ ✦

No. 1,915,281, MACHINE FOR FORMING MESH WIRES, Patented June 27, 1933, by Heinrich Bax, Brooklyn, N. Y.

More particularly, the invention covers a device for interlocking mesh. Each angular bent portion is offset with respect to the bent portion adjacent thereto, interlocking effected, and it is claimed the parts will not become detached.

✦ ✦ ✦

No. 1,915,722, WIRE DRAWING MACHINE, Patented June 27, 1933, by Charles H. Earnshaw, Fisherville, Mass., assignor to The American Steel and Wire Company of New Jersey, a Corporation of New Jersey.

A die-holding mechanism is provided whereby the bending or kinking action due to varying speeds of rotation of the drum is eliminated.

✦ ✦ ✦

No. 1,916,135, CENTER FOR WIRE ROPES, Patented June 27, 1933, by Bernard W. Gates, Pleasantville, N. Y., assignor to Plymouth Cordage Company, Plymouth, Mass., a Corporation of Mass.

The portion of the supporting center of this wire rope adjacent the wire strands is of paper and within the paper is a core having a number of paper turns twisted together and having contlines over which the paper is twisted.

✦ ✦ ✦

No. 1,911,541, WIRE FABRIC MACHINE, Patented May 30, 1933, by Charles C. Wickwire of Cortland, New York, assignor to Wickwire Brothers of Cortland, New York, a Corporation of New York.

Particularly the machine relates to those provided for manufacturing welded wire fabric of the type in which the strands pass diagonally with reference to the length of the fabric producing a diamond mesh. The welding roll comprises a cylinder having a number of overlapping electric current conducting contacts mounted thereon and arranged in the form of a spiral extending completely around the roll so that the welding circuit may be closed while making a complete roll of welds.

✦ ✦ ✦

No. 1,911,912, APPARATUS FOR TRANSFERRING ROD BUNDLES, Patented May 30, 1933 by John G. Mathieson of Donora, Pennsylvania, assignor to The American Steel and Wire Company of New Jersey, a Corporation of New Jersey.

One of the objects of the invention is to provide a machine which will transfer rod or wire bundles from the traveling conveyors to one of the hooks of the traveling hook conveyor without inverting the bundles thereon.

✦ ✦ ✦

No. 1,911,925, WIRE STRANDING MACHINE, Patented May 30, 1933 by Malcolm W. Reed of Worcester, Massachusetts.

The wire is carried on a number of rotatable supporting members arranged to rotate about fixed vertical axes and which may be in the form of reels to receive coils as delivered by the wire drawing machines or may be in the form of spool carriers adapted to support large capacity spools.

✦ ✦ ✦

No. 1,916,372, WIRE HEATING APPARATUS, Patented July 4, 1933, by William M. Hepburn and Ralph S. Fearnside, Toledo, Ohio, assignors to Surface Combustion Corporation, Toledo, Ohio, a Corporation of New York.

The invention relates to the annealing of wire or wire rods, the inventor providing means for winding the wire in laterally spaced loops about a loop supporting device.

Exports and Imports of Wire

Exports of iron and steel wire products in June, 1933 and June, 1932
(In gross tons)

	June 1933	May 1933	June 1932
Wire rods	1,312	532	693
Hoops, bands and strip steel	2,134	1,706	883
Plain black or galvanized iron or steel wire	1,694	889	468
Barbed wire and woven wire fencing	2,822	2,755	1,384
Woven wire screen cloth	76	37	51
Wire rope	157	112	69
Insulated iron or steel wire and cable—see analysis below			
Other wire and manufactures	264	256	198
Wire nails	1,141	688	483
Tacks	23	27	34
Other nails, including staples	322	257	213
Bolts, machine screws, nuts, rivets, and washers	263	264	193
Total, these 11 classifications	10,208	7,523	4,659

Imports of iron and steel wire and wire products into the United States
(In gross tons)

Concrete reinforcement bars	313	371	3,428
Hollow bars and drill steel	90	57	44
Merchant steel bars	1,844	1,099	3,173
Wire rods	1,431	961	457
Barbed wire	368	445	1,759
Round iron and steel wire	169	137	199
Telephone and telegraph wire	....	....	....
Flat wire and strip steel	102	87	56
Wire rope and strand	125	117	197
Other wire	105	108	86
Hoops and bands	1,955	1,131	2,382
Nails, tacks and staples	375	485	998
Bolts, nuts and rivets	16	34	16
Total, these 13 classifications	6,893	5,032	12,795

Exports of Insulated Wire and Cable
June, 1933

	Lbs.	Value
Insulated iron or steel wire and cable	57	$ 45
Rubber covered wire	147,893	26,536
Insulated copper weatherproof wire	81,352	9,242
Wire and cable telephone cable	4,286	513
Other insulated copper wire	146,246	28,789
Nickel-Chrome Electric Resistance Wire	33,439	29,766
Total, these 6 classifications	413,273	$94,891

JUNE exports were 20,488 tons smaller than were those of May, thus interrupting a climb which had extended for some six months prior to that month. The June decline was the result of the drop in the single item "scrap", the shipments of which were smaller by 24,497 tons. Gains were far more numerous; there were 42 in all out of a total of 61 classes of material. Most of them were, unfortunately, in small amount, the outstanding being those of 1,468 tons in skelp, and of 780 tons in wire rods, but combined with others they represented an increase of 4,009 tons of the May trade if the scrap item is excluded.

✦ ✦ ✦

WHETHER in June or for the elapsed six months of 1933 the markets of the Far East took the bulk of all products exported. In June 70 percent went to this area, against 63.7 percent for the 1933 six months' trade and 50.1 percent for the 1932 half year. The next best market area was North and Central America and the West Indies, to which 16.6 per cent of the June shipments and 13.8 percent of the 1933 trade went—small proportions compared with the 35 percent recorded for the first half of 1932. Over the first half of 1933, however, 16.8 percent of all exports found their way to these markets. South America does not compare favorably, the proportion being 5.3 percent both for June and for the 1933 half year, with only Africa lower—0.6 percent and 0.4 percent for the two periods.

✦ ✦ ✦

THE largest individual market in June was Japan, whose purchases of 58,027 tons included 56,429 tons of scrap and 1,229 tons of wire rods. Canada, with a total of 8,652 tons, purchased 820 tons of steel bars, 776 tons of hoops, and 660 tons of cold rolled strip steel—the total being greater by some 1,600 tons. The Philippine Islands was June's third market with a total of 5,970 tons including 496 tons of wire nails. Neitherlands took a total of 2,988 tons, including 205 tons of wire nails. Of the Mexican total of 2,832 tons, 372 tons were hoops and bands and 329 tons barbed wire.

✦ ✦ ✦

IMPORTS of iron and steel products in general, and of pig iron, ferromanganese, and structural shapes, in particular, rose in June, the gain of 8,073 tons bringing the total trade up to 34,361 tons. As far as individual products were concerned, three showed increased trade for every two which registered a reduction—all the latter being in small amount, however, whereas the gain in receipts of ferro-manganese amounted to 3,100 tons, and that in hoops and bands to 824 tons.

✦ ✦ ✦

OVER the elapsed six months of 1933 an opposite situation obtained with respect to the corresponding period of 1932. Imports in the earlier half-year period exceed those in the later by 56,517 tons, the 1933 total of 152,478 tons being the result of a series of marked declines, including reductions of 17,803 tons in imports of concrete reinforcement bars, of 10,230 tons in merchant steel bars, of 3,449 tons in barbed wire, and of 3,254 tons in hoops and bands. The only gains of moment were those of 6,611 tons in ferro-manganese, of 5,281 tons in scrap, and of 2,142 tons in wire rods.

✦ ✦ ✦

SHIPMENTS of ferro-manganese (6,233 tons) and of scrap (4,058 tons) were responsible for Canada's premier rank in the June import trade—her total of 10,796 tons being made up principally by these two items. Next was the Netherlands, with all but 40 of her 6,009 tons total pig iron. Third place went to Belgium, whose total

(*Please turn to page 285*)

'Round the World With the Wire Industry

German Translation of Wire Standards

THE German DIN (Deutsche Industrienormen—bureau of standards) is preparing a translation of standards for various cables, telephone and telegraph wires and hopes to be able thereby to induce the Post and Telegraph offices of Overseas markets to buy German standardized wire for these purposes.

✦ ✦ ✦

Italian and Continental Agreements on Non-Ferrous Wire

WHILE the agreement between a part of the continental and the Italian non ferrous wire industry seems to work quite smoothly there is no probability at present, that this agreement can be extended to iron and steel wire. On the contrary the Italian wire industry is trying to extend the wire export business further and is competing quite seriously in a number of markets, among which the Near East is most important. The Italian quotations for a number of products are considerably below the German and Belgian quotations.

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Second Hand Trade In Far East Increases

THE regular wire business is seriously feeling the competition of so called "second hand" or "waste material" wires. There has been always a good demand for such products in India and the Far East, particularly for so called "short ends", but the present business has assumed such a size that it is questionable if the trade is including only waste material. As a matter of fact many manufacturers sell first class wire at slightly lower prices than the office quotations and since they are not permitted to do so, they declare these shipments as "second hand" material. The market of course is being upset by such a proceeding.

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THE German wire cartel reports that turnovers in wire products for the first half of 1933 were 13% greater than last year, for the same period, but export shipments declined by 30%. Since May, export business to the American market is virtually dead, but a revival is anticipated from the advance of American quotations.

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Austria After Exports

AUSTRIA is an outsider of the IWECO and is now appearing on the export market. In 1931 the total shipment of wire nails was only 30 to 40 tons monthly, rising to 120 to 140 tons monthly last year, and 241 tons monthly in the first half of 1933. The wire nails are sold below the quotations of the IWECO mainly in the near East, and lately in Africa as well.

✦ ✦ ✦

German Wire Mills Separated From Steel Mills

THE wire and nail mills, formerly property of big steel concerns are being organized as separate companies and will continue operations as independent companies. The new Government laws forbid any seller of semi-finished steel to charge higher prices to a small consumer than to a great consumer, or an outsider of the cartel.

✦ ✦ ✦

Wire Rod Prices

THE Continental wire rod cartel has fixed the price for wire rods at L 4.15.0 gold for all market (fob continental port) except Great Britain, for which market a price of L 4.10 is quoted and for Japan, where the price cif (reduced to fob) corresponds to approximately L 4.5.0 gold. This reduction was necessary in order to meet the American competition, although according to most recent reports the American competition is not as keen as had been feared from the depreciation of the dollar.

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IWECO Changes Quotations

THE IWECO has finally followed the example of the export trade and is now quoting diversified prices for all markets. The practice to quote uniform prices fob European ports has therefore been finally abandoned. The prices, which had prevailed for approximately one year (as previously published in this paper) have been reduced by 10 to 12% for North America, 8 to 10% for South America, 6 to 8% for Central America, West India, England and Japan. For export to South Africa, East and West Africa, the Near East, except Palestine, prices have been advanced by 2 to 3% and for export to Scandinavia and the Balkans, by 5 to 6%. Prices for India and China are the same as before.

✦ ✦ ✦

THE Belgian, Luxembourgian and French makers of tacks and steel cut nails are trying to enter the IWECO, but the German manufacturers are unwilling to follow, therefore it is improbable that this department of the industry will be included in the cartel.

✦ ✦ ✦

Japanese Nails

THE Japanese wire nail competition has lost much of its strength which had been feared in the second half of 1932 and the first quarter of 1933. Exports of Japanese wire nails show a very sharp drop in the past few years. Export quantities declined by 35% in the second quarter of the year as compared with the first quarter and 42% as compared with the last quarter of 1932. Complaints and many refusals of shipments, late delivery, etc., are the explanation of the decline of Japanese exports.

✦ ✦ ✦

Tinsley Wire Industries, Ltd.

AN important development which will give Sheffield, the great British steel center, an entirely new industry, follows the registration of Tinsley Wire Industries, Ltd. The headquarters of

'Round the World With Wire Industry

this concern are part of the premises of William Cooke & Co., Tinsley, where several large disused shops are being demolished and new ones erected to deal efficiently with the specialized production of barbed wire and wire netting, in addition to other classes of wire products. The new enterprise will have the advantage of being able to command ample supplies of raw materials from associated companies. The works will be completed in about three months.

✦ ✦ ✦

Big New Anglo-French Phone Cable Ordered

A NEW Anglo-French telephone cable, for which a contract has been placed by the British Post Office, will have 19 star quads of unloaded copper conductors of 66 lb. per mile, the conductors being paper insulated and each quad separately screened with a layer of metallic tape to eliminate electrostatic interference between the circuits. The lead alloy sheath, in one continuous length, is protected from vibration by a cylindrical tube of a special rubber composition and from mechanical damage and abrasion by a layer of heavy steel wires.

✦ ✦ ✦

ON the English side the cable will be extended from St. Margaret's Bay to the repeater station as an unarmored duct cable, and on the French side from the coast (to the east of the Bassin de Chasses, near Calais) to the Calais repeater station as a steel-tape-armored cable. The submarine section, including spare cable, will be 29 nautical miles in length and will weigh nearly 1,125 tons.

✦ ✦ ✦

THE manufacture of the lead-covered core for the submarine section has been entrusted to Standard Telephones & Cables, Ltd., which will also provide the sections of underground cable between the submarine cable and the repeater stations on the respective coasts. The armoring and rubber covering of the lead-covered core of the submarine section will be undertaken by the Telegraph Construction & Maintenance Co., by whose cable ship Dominia the cable will be laid. It is anticipated that the cable will be completely installed by the beginning of September.

✦ ✦ ✦

British Enforce Merchandise Marks Act.

A case of interest to exporters interested in the British market for bolts, nuts, and screws was heard in London recently, when Baxters (Bolts, Screws & Rivets), Ltd., of Birmingham, were summoned for selling bolts and nuts which did not bear an indication of their place of origin, as defined in the Merchandise Marks Act. The firm pleaded not guilty.

✦ ✦ ✦

PROSECUTING counsel said that the offense alleged was that, although the word "foreign" was on the box containing the bolts, it was not conspicuous. Defending counsel replied that the trade-mark, which had contained the word "foreign," was scratched off at the request of the purchasers, and the order form was produced to prove this. Defendents had then stamped the word "foreign" on the boxes with a rubber stamp in larger letters than had originally been used. The firm had an excellent reputation and would not do anything of the kind with intent to deceive.

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THE Magistrate, Bernard Campion, K.C., held that the goods were not conspicuously marked, but that there was no intent to deceive. He refused to impose the maximum fine of £5, saying that that would lead people to think he regarded the case as a bad one, and he did not. He therefore imposed a fine of £4 and £6 6s. costs.

New Drumm Battery

DR. Drumm, inventor of the well-known Drumm battery used for electric traction on the Irish railways, has obtained a British patent covering improvements to his invention. According to the specification, the negative plate is made of nickel-zinc, nickel-chromium, or nickel-zinc-chromium alloys, examples being 94 to 95 per cent nickel, 6 to 5 per cent chromium; 80 per cent nickel, 20 per cent zinc. The alloys are prepared in a reducing atmosphere, and may be used as wire, gauze, tape, etc., with perhaps an "Armco" core. Plates of wire and gauze are improved by work-hardening.

✦ ✦ ✦

Dorman-Long Reorganization

THE long-awaited scheme for amalgamating Dorman Long & Company and the South Durham Steel & Iron Co., which includes the Cargo Fleet Iron Co., has just been announced in London. It involves a drastic financial reconstruction of Dorman, Long & Co., and the provision of a large amount of new money in order to pay certain sums to shareholders of the other enterprises as well as to provide additional working capital to meet the requirements of the merger company.

✦ ✦ ✦

THIS big scheme has been the subject of discussion and negotiation over a period of years, and the fact that at last it has been found possible to reconcile different interests and to secure the cooperation of the various parties concerned and the help of the Bankers Industrial Development Co., and other financial interests testifies to the fairness and desirability of the plan. The amalgamation will bring the vast iron and steel industry of Tees-side area under one direction and control.

(*Please turn to page 283*)

Registry of Used Wire Machinery

Conducted by

Dunscomb Associates

BOX 320, C/O WIRE AND WIRE PRODUCTS 17 EAST 42nd ST., NEW YORK, N. Y.

We Offer—Subject to Prior Sale—The Following Used Wire Mill Machinery

No. 230

Morgan Rod Bench
6-22" Friction Blocks
Gear Drive and Motor
2 Pointers
Block Speeds, 28 to 34 R. P. M.

No. 241A

10 block music wire bench with 16" blocks.
Complete with gear and chain drive, Motor and starter.

No. 302

For Sale

9 Die Richards
Continuous Machine
For Copper Rod

No. 231

Fifteen Frame for Wet Drawing
10 Blocks 12" Dia.
Block Speed 35 R. P. M.
McMahon Pinions

No. 280

One Nilson Wire Straightening and Cutting Machine, with horizontal and vertical rolls, 3/16" capacity.

If you have used machinery for sale let us hear from you. We have buyers.

No. 282

One Waterbury Farrel Foundry New No. 1 Continuous Wire Drawing Machine, with Spooling Attachment

No. 285

3 Shuster ⅜", and ½" capacity by 10' automatic wire straightening and cutting machines.

No. 321

Electric Platform Truck
Capacity 6000 lbs.
Platform 41" x 82" x 22½" High
24 Cells Edison A-6 Batteries

WE HAVE BUYERS FOR THE FOLLOWING

No. 290

SIXTEEN WIRE GALVANIZING

OUTFIT WITH 12-22" and 4-18" blocks, horizontal spindle type, preferably complete, but would consider take-up alone.

No. 291

Wanted
Lewis Automatic Straightening and Cutting Machine

No. 292

Wanted
Automatic Four Slide Forming Machines

No. 293

Wanted
Sleeper & Hartley Universal Spring Coilers

No. 301

No. 19 Wire Tubular Stranding Machine for 200 to 400 lb. bobbins, also Spooler for same.

No. 310

Wanted
Equipment For Tinning Wire

No. 311

Wanted
Equipment for Drawing Bright Wire From No. 22 to No. 30

No. 360

Wanted
No. 1 Tor and No. 1 Universal and No. 3 Universal Sleeper & Hartley Coilers.

No. 315

Wanted
Dumore Tool Postgrinders Complete with Attachments.

No. 316

Wanted
1 Electric Laboratory Oven
Baking Space 12" x 12" x 18"
Complete with Automatic Temperature Control and Indicating Pyrometer

If You Have Used or Surplus Machinery For Sale, Write for Details of our Plan. No Charge For Listing.

APPRAISALS ✦ ✦ ✦ STEEL AND NON-FERROUS ✦ ✦ ✦ INSPECTIONS

FOR DETAILS WRITE

Dunscomb Associates

BOX 320, C/O WIRE AND WIRE PRODUCTS 17 EAST 42nd ST., NEW YORK, N. Y.

REGISTRY OF USED WIRE MILL MACHINERY

The Wire Association

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Chief Metallurgist,
Wickwire Spencer Steel Co.,
New York, N. Y.

President
JOHN MORDICA
Supt., Rod and Wire Works,
Bethlehem Steel Company,
Sparrows Point, Md.

Vice President
J. CARLTON WARD JR.
Rome, N. Y.
General Cable Co.,
General Works Manager

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Richard E. Brown, Publisher, "Wire & Wire Products" 17 E. 42nd St., New York, N. Y.

John C. Callaghan, Works Manager, Canada Works, Steel Co., of Canada, Hamilton, Ont., Canada

E. W. Clark, Managing Engineer, Wire Dept., Gen. Elec. Co., Schenectady, N. Y.

Ralph K. Clifford, General Superintendent, Continental Steel Corp., Kokomo, Ind.

L. D. Granger, Assistant to Vice-President Wickwire-Spencer Steel Co., 41 E. 42nd St., New York, N. Y.

George D. Hartley, Treasurer & General Mgr., Sleeper & Hartley, Inc., Worcester, Mass.

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Kenneth B. Lewis, Consulting Engineer, 43 Midland Street, Worcester, Mass.

John R. McKean, Asst. Mgr., American Electrical W'ks, Phillipsdale, Rhode Island.

John Mordica, Superintendent Rod & Wire Works, Sparrows Point Plant, Bethlehem Steel Co. Sparrows Point, Maryland

George A. Paff, Supt., Rod & Wire Dept., Wheeling Steel Corp., Portsmouth, Ohio.

W. D. Pierson, Secretary, Waterbury Farrel F'dry & Mach., Co., Waterbury, Conn.

J. C. Ward, Jr., General Works, Mgr., General Cable Corp., Rome, New York.

THE WIRE ASSOCIATION

The Wire Association is a non-profit organization of wire mill executives, superintendents and foremen. It also includes plant engineers, traffic men, credit men, salesmen, and all others engaged in the wire industry, together with manufacturers, and other interested people who have something to sell to the wire mill or some service to render for pay.

Its specific purpose is to improve production methods and afford a clearing house for ideas on management problems, technical problems, and research work in all phases of practical wire drawing and wire working, and to develop and maintain friendly relations among the members.

✦ ✦ ✦ ✦ ✦ ✦ ✦ ✦ ✦

ACTIVITIES:

The Association functions along the following lines:

1. The use of the Association headquarters as a central clearing house for information and data of all kinds which may be of interest to members.
2. The exchange of ideas on processes of production including machinery, technical processes, etc.
3. The establishment and maintenance of friendly relations among the members of the association and the development of sectional and national meetings to discuss matters of mutual interest.
4. Studies of production methods and analysis of production costs.
5. Developments in the use of new materials and new applications of existing materials and by-products.
6. Research and collection of information on personnel management, including such factors as labor turnover, seasonal changes in the demand for employees, wage scales, etc.
7. Standardization and simplification as a means for the effective elimination of waste, including:
8. Such other subjects as may be determined upon.

AN INVITATION IS EXTENDED TO YOU TO BECOME A MEMBER

and To Come To The Meeting At Detroit, Oct. 2, 3, 4 and 5

✦ ✦ ✦

Annual Dues $10.00 Per Year

THE WIRE ASSOCIATION, 17 E. 42nd ST., NEW YORK, N. Y.

The undersigned hereby applies for membership in the Wire Association, and agrees to be governed by the Charter and By-Laws of the Society and to further its objects as laid down therein.

Name .....
(Firm, Organization or Individual applicant)

Address .....

Nature of Business .....

Name of Organization .....

Address of Organization .....

Applicant's Title or Occupation .....

All Wire Mill Men Are Invited to Attend
The Wire Association
1933 Meeting and Exhibition

Held in Association With the National Metal Congress

Detroit, Michigan

October 2, 3, 4, 5, 6 (inclusive) 1933

WIRE TECHNICAL SESSIONS

"Steel—Tuesday, October 3" **"Non-Ferrous—Thursday, October 5"**

Joint Session and Annual Meeting
Wednesday, October 4

Every wire mill production executive engaged in the manufacture of rod, wire and strip or the fabrication of wire and wire products of any kind is invited to attend.

REDUCED RATE RETURN TRIP RAILROAD CERTIFICATES
FURNISHED TO MEMBERS OF THE ASSOCIATION

Make Your Plans Now To Come and Participate in the Discussions

Association Headquarters at Book-Cadillac Hotel

If you are not a member--Now is the time to join. Annual Dues $10.00

MAKE YOUR PLANS NOW TO ATTEND THESE MEETINGS!

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RICHARD E. BROWN, Secretary
THE WIRE ASSOCIATION, 17 EAST 42ND STREET, NEW YORK, N. Y.

PROGRAM

Monday, October 2, 1933, at Hotel Book-Cadillac

A. M. and P. M. -- Registration--"Get Together" P. M. -- Informal meeting at headquarters of The Wire Association

These meetings will be held every night from 8 to 11 o'clock during the convention.

The Technical Sessions

TUESDAY, WEDNESDAY AND THURSDAY, OCTOBER 3-4-5, 1933

Program Committee

Ralph K. Clifford, Gen'l Supt., Continental Steel Corp., Kokomo, Ind., Chairman

Kenneth B. Lewis, Wire Mill Engineer, Worcester, Mass. W. D. Pierson, Sec'y. Waterbury Farrell Fdry. & Machine Co., Waterbury, Conn.

E. W. Clark, Managing Engineer, Wire Dept., General Electric Co., Schenectady, N. Y.

R. E. Brown, Secretary, The Wire Association, 17 E. 42nd St., New York, N. Y.

THERE WILL BE A REGISTRATION FEE OF $5.00 FOR THOSE ATTENDING THESE SESSIONS.

Stenographic Copies of the Discussions Will Be Available at $2.50 Per Copy.

At the technical sessions to be held Tuesday, Wednesday and Thursday, the papers will be brief and will be limited to one per session. It is intended that the time shall be spent in open discussion and exchange of experience in matters of general interest to wire mill operating men.

The discussions will cover, so far as time permits and in addition to matters arising naturally out of the papers read, a number of topics which have been suggested by members. The program committee will be glad to receive other suggestions. These topics are listed in the program schedule below.

✦ ◆ ✦

IN ADDITION TO THOSE PUBLISHED IN SEPTEMBER

AMONG THE QUESTIONS TO BE DISCUSSED ARE THE FOLLOWING

Are there any developments in either rod rolling or wire drawing machinery that would make it more economical or otherwise desirable to start drawing with a 7/16" Rod instead of the heretofore accepted standard of 1/4" or 5/16" Rod. This has reference to ordinary copper wire, not such wire as is drawn from large rods for the purpose of obtaining special tensile strength, elongation, etc.

✦ ✦ ✦

If they use hard drawn wire in the manufacture of screen cloth, why do the makers object to such wire being supplied to them drawn on spools, and would it be possible to standardize on the spool sizes used in the weaving process.

✦ ✦ ✦

Since the last meeting have any new facts come to light regarding drawing speeds in relation to die costs, particularly with regard to fine wire.

✦ ✦ ✦

Is it customary to bake the wire used for enamelled wire before applying the enamel, and why is it considered necessary.

✦ ✦ ✦

Is it true that 1/4" rolled rod is more satisfactory for drawing into fine wire (say No. 35 B & S and smaller) than a 5/16" rod.

✦ ✦ ✦

In the single hole drawing of copper rods why do some mills use soap powder and others tallow or grease for lubricating the dies on the first draft, and what is the difference in the results obtained.

✦ ✦ ✦

Is any information or any formula available as to the power required to draw rectangular or square stock through a die. Does the power consumption depend entirely on the area reduction, or does the surface in contact with the die also have to be taken into consideration.

✦ ✦ ✦

What combination of wire sizes, drawing speeds and coil weights are considered practical when drawing wire on a block.

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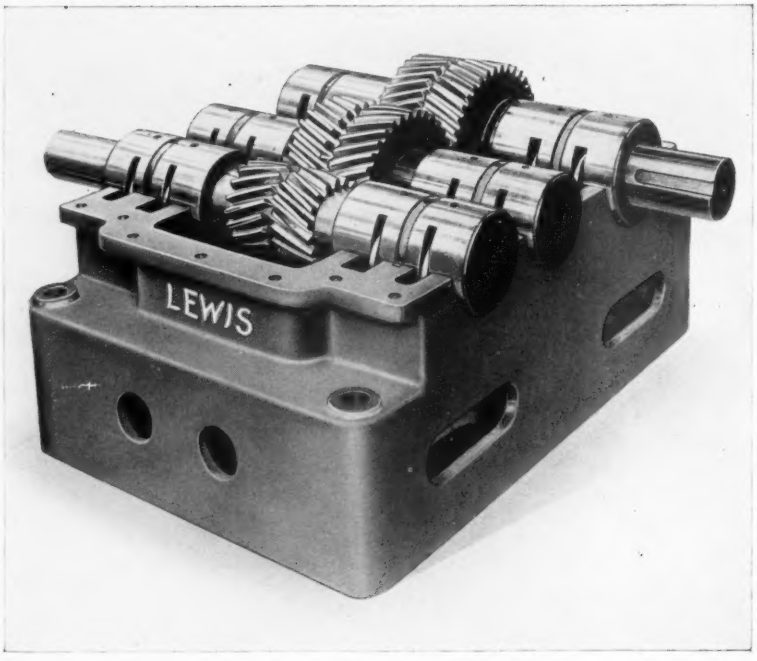
THE WIRE ASSOCIATION, 17 EAST 42ND STREET, NEW YORK, N. Y.

LEWIS

+ + + + + HIGH SPEED GEAR SET

FOR CONTINUOUS ROD MILL



Lewis High Speed Gear Sets are in use where quality and efficiency really count. The largest and most up-to-date rod mill unit in the world utilizes Lewis Gear Sets for driving its roll stands.

Lewis gear housings are of two piece type with special alloy forged steel herringbone cut tooth gears running in babitted shell type or roller bearings. One Lewis gear set is used for driving two roll stands which is a special feature for controlling roll speeds when driven by either individual motors or bevel gear drives. Lewis gear sets are totally enclosed and gears and bearings run continuously in oil.

Lewis Engineers will gladly cooperate with you in designing special machinery to meet your problems.

NRA WE DO OUR PART

THE LEWIS FOUNDRY & MACHINE CO.
BOX 1591
PITTSBURGH, PA.

Early Development of The Rolling Mill

(*Continued from page 264*)

IN 1860, with the development of the telegraph there was a demand for the longest possible lengths of wire. For this purpose Beard and Thomas of Bilston, England, built a looping mill to run at 500 RPM which produced lengths up to 130 feet.

✦ ✦ ✦

Since those days, there have been developments with which we are more or less familiar.

✦ ✦ ✦

CONTINUOUS rolling was invented and developed by an Englishman, George Bedson, who built an experimental mill in 1862 for rolling wire rods. Previous to this, the nearest approach to continuous rolling had been performed in 1720, on a two stand mill driven by water wheels. On account of industrial conditions existing in England in the middle of the nineteenth century, Bedson never had the opportunity to develop his mills as extensively as he might have done. In 1868 he erected a 16 stand rod mill of alternate horizontal and vertical rolls. Later, one of his mills was put down in this country from which date the development of continuous rolling passed into the hands of the American engineers, who have extended its application to many diversified uses.

✦ ✦ ✦

Acid Dipping

(*Continued from page 265*)

in the endeavor to evolve a simpler method of cleaning stainless steels, but the present system of first immersing in a 5 per cent, hot sulphuric bath, followed by a 15 to 20 per cent cold nitric bath, still remains the most effective. An alternative method of cleaning stainless steels is to use a mixture of 15 to 20 per cent muriatic acid and 5 per cent nitric acid. This liquor is used in a cold condition, but care has to be exercised, as the hydrochloric acid attacks the material much more keenly than sulphuric acid does.

✦ ✦ ✦

Restrainers or Inhibitors

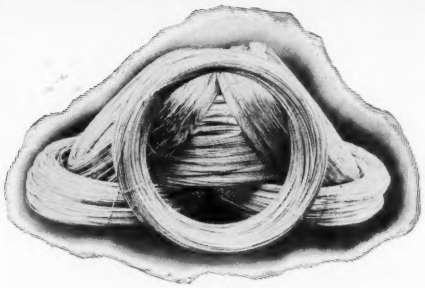
DURING the past few years there have appeared upon the

market a number of products termed restrainers or inhibitors, the purpose of which is to restrain the action of the acid on exposed metal while other parts are being treated to remove scale which is proving more difficult to dislodge. Various claims have been made for these products, particularly in eliminating acid brittleness in high carbon steels, but many wire manufacturers still stand aloof from adopting them. The assertion that they keep the atmosphere of the department more free from fumes is undoubtedly true, but the same purpose could easily be achieved by using a half strength solution of cleaning liquor. In a well ventilated acid-dipping department there should be little complaint of fumes, except on windless days, when even restrainers will have little effect in preventing fumes.

✦ ✦ ✦

IN comparing muriatic, sulphuric and nitric acids as wire cleaners, it may be stated that the climate is a big factor in the successful cold working of muriatic acid. yet more pronounced advantages could be gained if this acid is worked in a heated state. The disadvantage asserted, that by running steam into the liquor the latter is weakened, is not borne out by actual working conditions. In one way the steam certainly does weaken the liquor, but at the same time the steam heat continually drives off moisture, thus tending to concentrate the liquor again. Allowing for the weakening by the attack of the acid on the metal, it is found that there is practically little waste. Sulphuric acid, however, is undoubtedly the best wire cleaning medium. It is quicker, and there is little cause to fear trouble in the finished wire from acid rust. The necessary use of steam as a heating medium is added expense as against the cold working of muriatic acid, but cost for cost, less sulphuric is needed to clean an equal amount of material.

SILVER BRIGHT GALVANIZED



We furnish this highly finished galvanized wire to meet your requirements as to coating, tensile strength, bend test, etc. Packed in coils or straightened and cut to length. Our organization will be glad to offer its long experience in wire problems toward the betterment of your product or a reduction in its cost. Call on us.

✦ ✦ ✦

We make a complete line of nails in various sizes and types. Also the following kinds of wire:

BRIGHT BASIC
COPPER-BEARING
ANNEALED
LIQUOR FINISH
TINNED
COPPERED
"GALVANNEALED"
ROPE WIRE
TELEPHONE WIRE
SPRING WIRE
WELDING RODS

KEYSTONE STEEL & WIRE COMPANY
3000 Industrial Street PEORIA, ILL.

'Round the World With the Wire Industry

(*Continued from page 277*)

THE combined steel products output of the merging companies in 1929 was 1,523,000 tons, out of a total output for Britain of about 8,550,000 tons. According to an independent estimate the merger should earn a trading profit of £700,000 ($3,500,000) a year on an average output of 1,125,000 tons per annum.

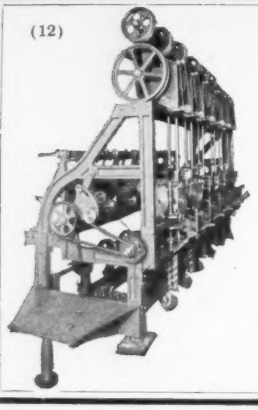
✦ ✦ ✦

THE drastic nature of the Dorman Long financial reconstruction will surprise those less well informed, but not those who realize that the British iron and steel industry, of which the company is one of the most important units, has been passing through a lengthy period of abnormal depression, coupled with very severe foreign competition. onsequently it has not been possible to write off obsolete plant or to write down the modern plant built during the costly war and post-war period.

THIS explains the severe writing down. The value of the assets has been reduced to the basis of present earning power, that being a condition of the merger. The new finance, which will amount to £2,500,000 ($12,500,000), of which it is proposed to issue £2,23,000 ($11,150,000) privately to begin with, will take the form of 5 per cent prior lien stock. Holders of the exsiting £5,135,944 5½ per cent first mortgage redeemable debenture stock, are to receive 110 per cent in new securities, of which 50 per cent will be in 5½ per cent debentures with modified rights and 60 per cent in equal amounts of preference and preferred ordinary shares.

Make Your Plans Now
To Attend The
Wire Association Meeting
At Detroit

(12)



VERTICAL MODEL TAPING MACHINE

for applying 3 Tapes on each of six lines of wire, for flat or round conductor, with wire straightening rolls and individual traverse for each line of wire; motor or belt drive.

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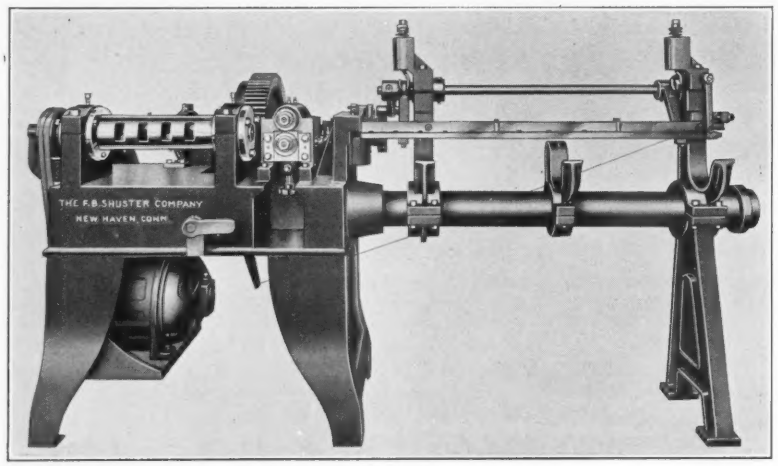

High Speed Automatic Straightening and Cutting Machine.

✦ ✦ ✦ ✦ ✦

A RECENT addition to the line of Automatic Wire Straightening and Cutting Machines made by The F. B. Shuster Company of New Haven, Conn., is shown herewith—their new "High Speed" machine.

Many advantages are claimed for it, among them being the almost continuous movement of the wire, which is brought about by the use of a specially designed cut off cam, and a specially designed clutch which is practically instantaneous in operation.

High speed is possible in the cut off because the cover which closes the guide bar (the bar into which the wire is fed to be cut off) is operated independently of the cut off lever, and the guide bar itself is permanently fixed to the uprights.

The straightening flier, the fly wheel, and also the high speed driving shaft are all mounted on ball bearings. The hand wheel adjustment for the feed rolls is located in an opening in the bed of the machine, and the lower roll boxes are released at the time of cutting off.

Breaking rolls may be supplied if desired, although the machine is shown without any rear rolls.

There is a substantial bed, mounted on heavy legs, and the pipe supporting the extension is cast into the bed, which makes a very rigid construction. The motor is mounted underneath the machine. The extension is along the general lines of their standard construction, with forked holders for catching the cut lengths.

All Papers Presented at the Wire Associatian Meeting to be held at Detroit, October 2, 3, 4 and 5, 1933, will be All Papers Presented at the Wire Association Meeting

New British Testing Machine

(Continued from page 270)

ensuring that the wire is in the vertical position before bending commences. The top guides serve in addition as distance pieces to regulate the distance at which pressure is applied during bending. The machine has fourteen of these pieces, which are accommodated on a special tray attached to unit. Each distance piece is marked with the size of wire it accommodates and the dies with which it should be used. A counter is fitted on the right of the machine, this being indispensable for inspection work.

✦ ✦ ✦

THIS machine should prove of great use on account of its sturdy open construction and accuracy of manufacture.

✦ ✦ ✦

Nichrome

"NICHROME" is the title of a book bearing the serial number of R-33, issued by the Driver-Harris Company of Harrison, N. J., to assist in the selection of alloys used for electrical, mechanical and chemical purposes.

THIS booklet is very handsomely presented in color, containing diagrams, tables and charts, together with data on current temperature characteristics, etc., of the various types of alloy wire produced by this Company.

THE booklet also includes useful data on direct electric current, together with the tables of weights, measures, wire gauges, conversion factors, etc., of interest to all wire engineers.

Information Service

Improvements in processes and methods of production for rod, wire, strip and insulated wire and cable are being constantly made.

Technical processes of production are being developed consistently.

To members of the Wire Association an information service is available by which they can obtain data on any subject relating to the industry on which they desire information.

WHY DON'T YOU JOIN THE WIRE ASSOCIATION:

ADDRESS THE SECRETARY

Richard E. Brown, 17 East 42nd St., New York, N. Y.

Exports And Imports

(*Continued from page 275*)

of 5,497 tons included, 1,205 merchant steel bars, and 986 tons of hoops. Fifth place went to France, with a total of 2,153 tons, of which 588 tons was hoops and bands.

✦ ✦ ✦

AFTER declining in May card clothing imports rose in June to total 15,289 square feet valued at $14,678, 13,642 square feet ($12,887) coming from the United Kingdom and 1,647 square feet ($1,791) from Germany.

✦ ✦ ✦

WIRE cloth and screening imports continued to decline and amounted to only 8,080 square feet in June—4,569 square feet coming from Canada, 2,494 square feet from Germany, and the rest from Switzerland.

✦ ✦ ✦

FOURDRINIER wire imports, on the other hand, rose to 75,581 square feet, Austria being the largest supplier with 36,564 square feet, followed by Germany with 21,116 square feet, France with 10,350 square feet, Sweden with 7,291 square feet, and Belgium with 256 square feet.

✦ ✦ ✦

WIRE fencing and netting imports were greater in June. Of fencing galvanized before weaving, 701,700 square feet were imported, 382,800 square feet from Belgium and 318,900 square feet from the Netherlands; while of that galvanized after weaving, 2,845,700 square feet were received —1,312,500 square feet from Germany, 1,057,750 square feet from the Netherlands, and 475,450 square feet from Belgium.

✦ ✦ ✦

IN the wood screw market exports of iron and steel wood screws amounted to 16,028 gross, valuated at $3,243. Exports of brass wood screws amounted to 2,637 gross at a value of $710.

✦ ✦ ✦

THE imports were small coming from Netherlands, Sweden and Canada, amounting to 800 gross at a value of $121.

STEELSKIN

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For High or Low Carbon Wire

WIRE DRAWING SOAPS

Established 25 years.

R. H. MILLER CO., Inc. Homer, N. Y.

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NRA Activities Among The Manufacturers

(*Continued from page 271*)

SINCE the rules of practice governing the sale and servicing of Tungsten Carbide Dies will necessarily be different from those governing the sale and handling of diamond dies, it would seem that this group, in order to assure success for this division of their code, should secure the cooperation of the great companies named who have not already joined in this endeavor.

✦ ✦ ✦

THE formation of these various associations will undoubtedly result in some changes in methods of doing business with the wire mills and managements should scrutinize the various codes carefully in order to ascertain what differences in practices will result from the institution of these codes.

All wire association papers will be published in the October issue of Wire.

EFFICIENT PICKLING

REQUIRES "RODINE"

RODINE, SAVES ACID AND METAL. Prevents over-pickling. Minimizes acid brittleness and acid fumes.

Samples and Directions sent on request.

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Best Inhibitor for Pickling

The WM. M. PARKIN CO.

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PITTSBURGH, PA.

ZINC WIRE
STRIP ZINC
EYELETS

THE PLATT BROS. & CO.
WATERBURY, CONN.

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Wire Mill Equipment, Stranding, Insulating, Drawing, Welding
Thomson-Judd Wire Machinery Co.
Subsidiary of
Thomson-Gibb Electric Welding Co.
Lynn, Massachusetts.

Sir Ernest Moir Passes

Sir Ernest Moir, Bart, famous British engineer who was greatly interested in the cable industry, died in London recently, aged 70. Sir Ernest commenced his engineering experience by being articled to two Glasgow firms in succession, namely Chaplin & Co., Ltd., and R. Napier & Sons. On the completion of his apprenticeship, he became associated with the firm of Tancred Arrol & Co., and it was in this connection that he was called upon to take part in the construction of the Forth Bridge, and, though comparatively young, he was given charge of the erection of the southern cantilevers. On finishing his section of the Forth Bridge, he was appointed resident engineer on the Hudson River Tunnel Works in New York.

✦ ✦ ✦

IN 1900 Moir was appointed a director of S. Pearson & Son, Ltd., and took a leading part in many of the firm's activities, including the building of the great Blackwall Tunnel, London, for which he designed the plant and controlled the work to its completion. Other works which he directed included the extension of the Surrey Commercial Docks, London, now called the King George V. Dock; the Great Northern & City Railway; the Naval Harbor at Dover; Naval Defence Works at Dover; great port works at Valparaiso; and an important reservoir for the Belfast Water Commission.

Sir Ernest was also a director of the Callender's Cable & Construction Co., Ltd., and of the Anchor Cable Co., Ltd. In 1916 he was created a baronet, while he was also an Officier de la Legion d'Honneur.

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At Detroit

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Rod Frames—16″ Frames, 8″ Frames —Take-Up Frames, Wire Pointers—Puller Tongs.
General Castings for Wire Mill use.
Circulars on Request.
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Trenton, N. J.

WIRE STRAIGHTENING AND CUTTING MACHINERY
FOR ALL SIZES, SHAPES AND KINDS OF WIRE
The F. B. Shuster Co.
New Haven, Conn.
Straightener Specialists Since 1866

JOHN ROYLE & SONS
PATERSON, NEW JERSEY.
MAKERS OF EXTRUDING MACHINES FOR COVERING ELECTRIC CONDUCTORS AND WELDING WIRE

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See Furnaces—Various Headings

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National Wrought Iron Annealing Box Co., Washington, Pa.
Scudder, E. J., Fdry & Machine Co., Trenton, N. J.

ARMORING EQUIPMENT
Amer. Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.

BAKERS
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

CASTINGS—Wire Mill
E. J. Scudder Foundry & Machine Co., Trenton, N. J.

CHEMICALS—Cleaning
American Chemical Paint Co., Ambler, Pa.

CHROME NICKEL—Construction
National Wrought Iron Annealing Box Co., Washington, Pa.

CLEANING & PICKLING EQUIPMENT
Broden Construction Co., Cleveland, O.
Fred'k M. Conran, Newark, N. J.
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

COILERS—Sheet and Wire
H. J. Ruesch Machine Co., Newark, N. J.

CRANES—Wire Mill
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

DIES—Composition
Vianney Wire Die Works, New York, N. Y.

DIES—Diamond
Balloffet Diamond Wire Dies Co., Inc., N. Y. C.
Cochaud Wire Die Co., New York.
Driver-Harris Co., Harrison, N. J.
Vianney Wire Die Works, New York.

DIES—Lead Extrusion
John Robertson Co., Brooklyn, N. Y.

DIES—Repairs & Re-Cutting
Balloffet Diamond Wire Dies Co., Inc., N. Y. C.
Cochaud Wire Die Corp., New York.
Driver-Harris Co., Harrison, N. J.
Firth-Sterling Steel Co., McKeesport, Pa.
Vianney Wire Die Wks., N. Y.

DIES—Recutting and Repolishing Machine
Vianney Wire Die Works, New York, N. Y.

DIES—Rod and Tube Drawing
Carboloy Co., Inc., Newark, N. J.
Firth-Sterling Steel Co., McKeesport, Pa.
Master Wire Die Co., New York, N. Y.
Vianney Wire Die Works, New York, N. Y.

DIES—Tantalum Carbide
Vianney Wire Die Works, New York, N. Y.

DIES—Tungsten Carbide
Carboloy Co., Inc., Newark, N. J.
Driver-Harris Co., Harrison, N. J.
Master Wire Die Co., New York, N. Y.
Vianney Wire Die Works, New York, N. Y.

DRAW BENCHES—
H. J. Ruesch Machine Co., Newark, N. J.
Scudder, E. J., Fdry & Machine Co., Trenton, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.

ENGINEER—Consulting Wire Mill
Jagielski, Otto, Yonkers, N. Y.
Lewis, Kenneth B., New York, N. Y.

EYELETS—Zinc
Platt Bros. & Co., The, Waterbury, Conn.

FURNACES—Annealing
Electric Furnace Co., Salem, O.

FURNACES—Automatic
Electric Furnace Co., Salem, O.

FURNACES—Bright Annealing
Electric Furnace Co., Salem, O.

FURNACES—Electric
Electric Furnace Co., Salem, O.

FURNACES—Lead Melting
Electric Furnace Co., Salem, O.
John Robertson Co., Brooklyn, N. Y.

FURNACES—Non-Oxidizing
Electric Furnace Co., Salem, O.

GALVANIZING ENGINEER
W. H. Spowers, Jr., New York, N. Y.

FURNACES—Wire
Electric Furnace Co., Salem, O.

GALVANIZING KETTLES—
National Wrought Iron Annealing Box Co., Washington, Pa.

INHIBITORS—
American Chemical Paint Co., Ambler, Pa.
Wm. M. Parkin & Co., Pittsburgh, Pa.

LATHES—Die Reaming
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

LIME—Pulverized
Amer. Lime & Stone Co., Bellefonte, Pa.

LUBRICANTS—Wire Drawing
R. H. Miller Co., Homer, N. Y.
Robertson, J. T., Inc., Syracuse, N. Y.

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American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
John Robertson Co., Brooklyn, N. Y.
Sleeper & Hartley, Inc., Worcester, Mass.
Thomson-Gibb Electric Welding Co., Lynn, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Braiding
New England Butt. Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Brazing
Thomson-Judd Wire Machinery Co., Lynn, Mass.

MACHINERY—Bunching
Amer. Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Bundling
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.
Watson Machine Co., Paterson, N. J.

MACHINERY—Cable, Electric
American Insulating Machinery Co., Philadelphia, Pa.
Fred'k M. Conran, Newark, N. J.
New England Butt Co., Providence, R. I.
Thomson-Gibb Electric Welding Co., Lynn, Mass.
Watson Machine Company, Paterson, N. J.

MACHINERY—Chain Making
Fred'k M. Conran, Newark, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Closing
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Coil Winding
Fred'k M. Conran, Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Coilers
Broden Const. Co., Cleveland, O.
Fred'k M. Conran, Newark, N. J.
H. J. Ruesch Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.

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MACHINERY—Copper Wire Drawing and Rolling
Kratos-werke Aktiengesellschaft Gruna 1, SA. Germany
H. J. Ruesch Machine Co., Newark, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Cutting
Broden Construction Co., Cleveland, O.
F. B. Shuster Co., New Haven, Conn.
Sleeper & Hartley, Worcester, Mass.

MACHINERY—Enameling
American Insulating Mach'y Co., Phila., Pa.

MACHINERY—Extruding
John Robertson Co., Brooklyn, N. Y.
John Royle & Sons, Paterson, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Flat Wire
Broden Construction Co., Cleveland, O.
Fred'k M. Conran, Newark, N. J.
H. J. Ruesch Machine Co., Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Forming
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Galvanizing Wire
Broden Construction Co., Cleveland, O.
Fred'k M. Conran, Newark, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Gang Winders
H. J. Ruesch Machine Co., Newark, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Insulating
American Insulating Machinery Co., Phila.
New England Butt Co., Providence, R. I.
John Royle & Sons, Paterson, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Lead Encasing Presses, etc.
John Robertson Co., Brooklyn, N. Y.

MACHINERY—Lead Stripping
John Robertson Co., Brooklyn, N. Y.
Watson Machine Co., Paterson, N. J.

MACHINERY—Lock Washer
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Magnet Wire
American Insulating Mach'y Co., Phila., Pa.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Measuring Wire & Cable
Lyon Measuring Machine Division of Barbour Welt'ng Co., Montello, Mass.
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Nail
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Panning
American Insulating Machinery Co., Phila.

MACHINERY—Pointing
Broden Construction Co., Cleveland, O.
Fred'k M. Conran, Newark, N. J.
H. J. Ruesch Machine Co., Newark, N. J.
E. J. Scudder Foundry & Machine Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Rod Mill
Broden Construction Co., Cleveland, O.
Fred'k M. Conran, Newark, N. J.
Morgan Const. Co., Worcester, Mass.
H. J. Ruesch Machine Co., Newark, N. J.
Lewis F'dry & Machine Co., Pittsburgh, Pa.

MACHINERY—Rolling Mill
Broden Construction Co., Cleveland, O.
Fred'k M. Conran, Newark, N. J.
Lewis F'dry & Machine Co., Pittsburgh, Pa.
Morgan Construction Co., Worcester, Mass.
H. L. Reusch Machine Co., Newark, N. J.

MACHINERY—Rubber Strip Covering
John Royle & Sons, Paterson, N. J.
New England Butt Co., Providence, R. I.
Watson Machine Co., Paterson, N. J.

MACHINERY—Rubber Tubing and Straining
John Royle & Sons, Paterson, N. J.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Screw Wire
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Special
American Insulating Mach'y Co., Phila Pa.
Broden Construction Co., Cleveland, O.
Fred'k M. Conran, Newark, N. J.
H. J. Ruesch Machine Co., Newark, N. J.
E. J. Scudder Foundry and Machine Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Spooling
American Insulating Machinery Co., Phila.
Fred'k M. Conran, Newark, N. J.
Vaughn Machinery Co., Cuyahoga Falls, O.
Watson Machine Co., Paterson, N. J.

MACHINERY—Spring Making
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Staple
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Straightening
Broden Construction Co., Cleveland, O.
H. J. Ruesch Machine Co., Newark, N. J.
F. B. Shuster, New Haven, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.

MACHINERY—Straightening Hollow Wire
Fred'k M. Conran, Newark, N. J.

MACHINERY—Stranding
Fred'k M. Conran, Newark, N. J.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Thomson-Judd Wire Machinery Co., Lynn, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Strip Steel
Broden Const. Co., Cleveland, O.
Fred'k M. Conran, Newark, N. J.
Lewis F'dry & Machine Co., Pittsburgh, Pa.
H. J. Ruesch Machine Co., Newark, N. J.

MACHINERY—Swaging
H. J. Ruesch Machine Co., Newark, N. J.
Sleeper & Hartley, Worcester, Mass.

MACHINERY—Taping
Amer. Insulating Mach. Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Thomson-Judd Wire Machinery Co., Lynn, Mass.
Watson Machine Company, Paterson, N. J.

MACHINERY—Tinsel Rolling Mills
Amer. Insulating Mach'y Co., Phila., Pa.

MACHINERY—Trolley Wire
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Tube Mill
Fred'k M. Conran, Newark, N. J.
H. J. Ruesch Machine Co., Newark, N. J.

MACHINERY—Welding Wire
F. B. Shuster Co., New Haven, Conn.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Winding
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Providence, R. I.
Sleeper & Hartley, Inc., Worcester, Mass.
Watson Machine Co., Paterson, N. J.

MACHINERY—Wire Drawing
American Insulating Machinery Co., Phila.
Broden Const. Co., Cleveland, Ohio.
Fred'k M. Conran, Newark, N. J.
Kratos-werke Aktiengesellschaft Gruna 1, SA. Germany
Morgan Construction Co., Worcester, Mass.
H. J. Ruesch Machine Co., Newark, N. J.
E. J. Scudder Foundry & Machine Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.
Thomson-Judd Wire Machinery Co., Lynn, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

MACHINERY—Wire Rope
New England Butt Co., Providence, R. I.
Thomson-Judd Wire Machinery Co., Lynn, Mass.
Watson Machine Company, Paterson, N. J.

PACKING—Metallic Fibre
Hudson Wire Co., Ossining, N. Y.

PICKLING COMPOUNDS—
American Chemical Paint Co., Ambler, Pa.

PICKLING AND PLATING TANKS
Haveg Corporation, Newark, Del.

MACHINERY—Wire Tinning
American Insulating Mach'y Co., Phila., Pa.

POTS—Lead Melting
John Robertson Co., Brooklyn, N. Y.

PRESSES—Lead Encasing
John Robertson Co., Brooklyn, N. Y.

PRESSES—Lead Extrusion
John Robertson Co., Brooklyn, N. Y.

PULLERS—Wire
E. J. Scudder Fdry. & Machine Co., Trenton, N. J.
Sleeper & Hartley, Inc., Worcester, Mass.

PUMPS—Hydraulic
John Robertson Co., Brooklyn, N. Y.

REELS AND SPOOLS—All Kinds
R. B. Hayward Co., Chicago, Ill.

REEL AND TENSION STAND—
Sleeper & Hartley Inc., Worcester, Mass.

REEL CRUTCHES
R. B. Hayward Co., Chicago, Ill.
Watson Machine Co., Paterson, N. J.

ROLLING MILLS—See Machinery—Rolling Mill

ROLLS—
Lewis F'dry & Machine Co., Pittsburgh, Pa.

SOAPS—Wire Drawing
Drakenfeld & Co., B. F., New York, N. Y.
R. H. Miller Co., Homer, N. Y.

SPOOLS—Aluminum Alloy
Lestershire Spool Co., Johnson City, N. Y.

STEEL PLATE CONSTRUCTION—
National Wrought Iron Annealing Box Co., Washington, Pa.

STRIP—Zinc
Platt Bros. & Co., The, Waterbury, Conn.

TANKS—Compound
Haveg Corporation, Newark, Del.
Watson Machine Co., Paterson, N. J.

TANKS—Steel Plate
National Wrought Iron Annealing Box Co., Washington, Pa.

TRUCKS
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, O.

TUBE BENDERS AND FORMERS
H. J. Ruesch Machine Co., Newark, N. J.

VULCANIZERS
John Royle & Sons, Paterson, N. J.
Watson Machine Co., Paterson, N. J.

VULCANIZING PANS
American Insulating Mach'y Co., Phila., Pa.

WIRE—Enameled For Coils
Winsted Insulated Wire Co., Winsted, Conn.

WIRE—Manufacturers
Keystone Steel & Wire Co., Peoria, Ill.

WIRE—Nickel Silver and Phosphor Bronze
Hudson Wire Co., Ossining, N. Y.
Seymour Mfg. Co., Seymour, Conn.

WIRE—Non Ferrous to Specification
Hudson Wire Co., Ossining, N. Y.
Seymour Mfg. Co., Seymour, Conn.
Winsted Insulated Wire Co., Winsted, Conn.

WIRE—Steel—Also Coppered Steel—Also Glavanized Steel
Keystone Steel & Wire Co., Peoria, Ill.

WIRE AND STRIP—Zinc
Platt Bros. & Co., The, Waterbury, Conn.

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ESTABLISHED 1845

PATERSON, NEW JERSEY, U. S. A.

Electric Cable and Wire Rope Machinery:

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PAIRING & TRIPLING MACHINES	For Bare & Insulated Wire.
CLOSERS	For Wire in Planetary, High-speed & Angular types.
CLOSERS & CABLERS	For electric cable in Planetary and Angular types.
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TAPING HEADS	For applying steel tape in Eccentric and Concentric high-speed types.
JUTE & BURLAP	Applying Heads.
THREAD SERVERS	For Cotton, Asbestos, etc. application on hose and wire.
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CHALK APPLIERS	Wet and Dry types.
CAPSTAN SECTIONS	With Single tapered and double grooved wheels, with Lay Control by gears or variable speed transmission.
LET OFF REEL STANDS	Shaft and Shaftless types, for any size of reels.
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COILING MACHINES	Power or manual drive for package coiling—also for warehouse and shipping room use.
COILING HEADS	For wire rope and insulated wire and cable.
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TRAVERSES	Light and Heavy, manual, mechanical and motorized.
TEMPERING & GALVANIZING MULTIPLE HEAD TAKEUPS	For wire.
MEASURING MACHINES	For Length Measurement.
ELECTRIC PATCH VULCANIZERS	
SATURATING, WAXING & GREASING TANKS	Gas fired and Electrical.
WIRE TINNING MACHINES	Gas fired and Electrical.
CABLE PEELERS	For removing lead sheathing and insulation.
POLISHING HEADS	Separately or Motor driven.
REEL CRUTCHES	For turning heavy reels in handling and shipment.
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CUTTERS	For wire rope, cable and chain.
SPOOLS	Heavy-duty for Rope-Mills and Cable-plants.

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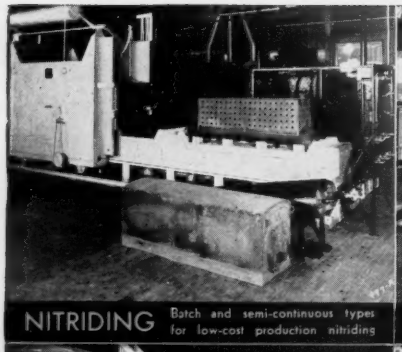
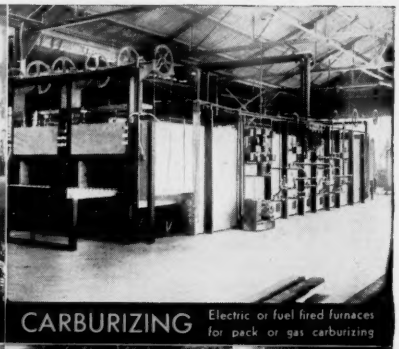
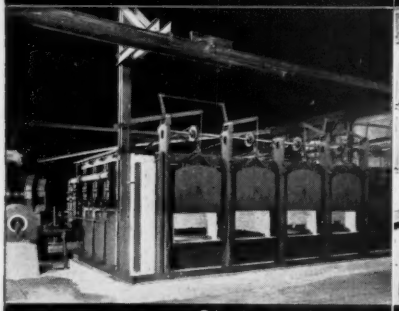


NITRIDING Batch and semi-continuous types for low-cost production nitriding

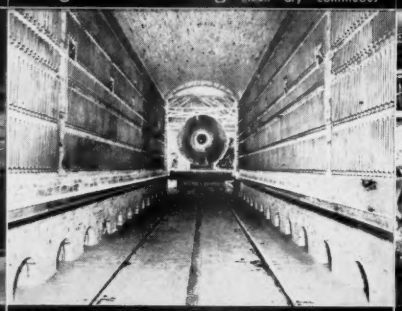
Bright Annealing Ferrous and non-ferrous clean - dry - continuous



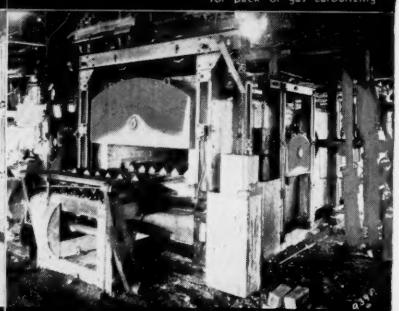
CARBURIZING Electric or fuel fired furnaces for pack or gas carburizing



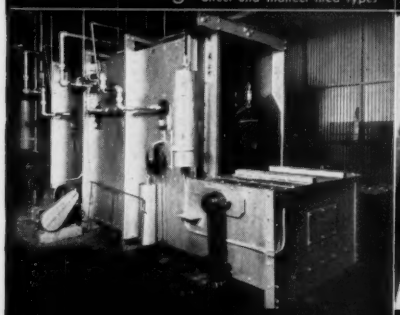
Billet Heating Oil and gas fired furnaces -- direct and indirect fired types



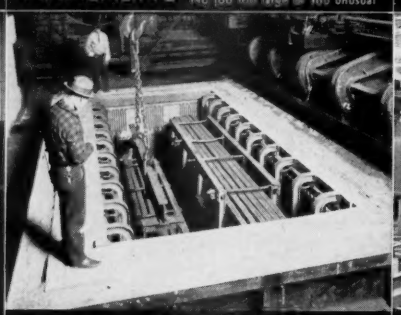
ANNEALING Oil stills up to 67 ft. in length. No job too large or too unusual



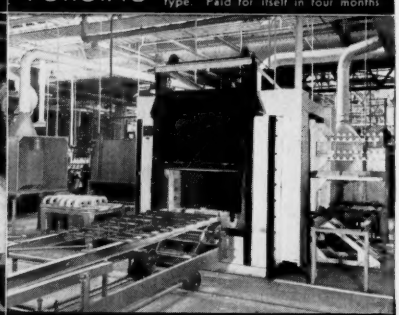
FORGING Continuous grooved hearth pusher type. Paid for itself in four months



HARDENING Chain belt furnaces for miscellaneous products - over 50 in use

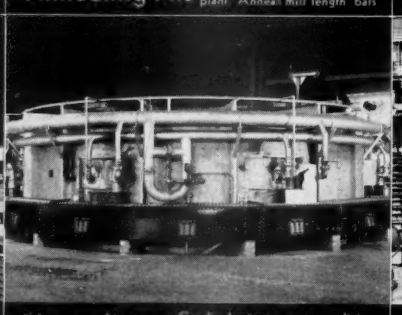


Annealing Pits One of a battery of five in one plant. Anneal mill length bars



ENAMELING Furnaces in continuous and batch types - - - electric or fuel-fired

Heat Treating 32 hearth type furnaces -- capacity 450,000 lbs. per day



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Heat Treating Structural shapes 90 feet long uniformly treated in this furnace

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ELECTRIC FURNACES